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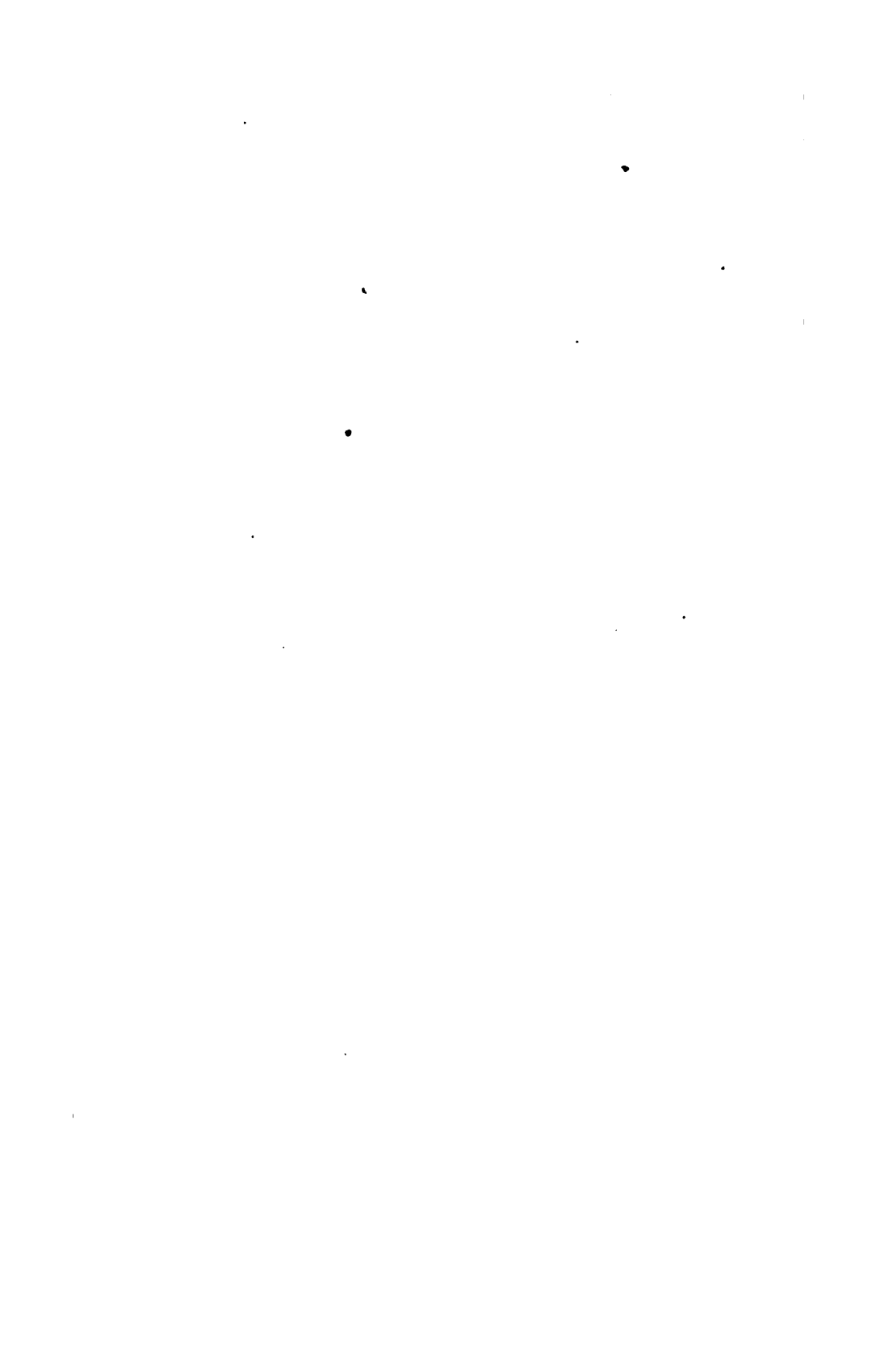
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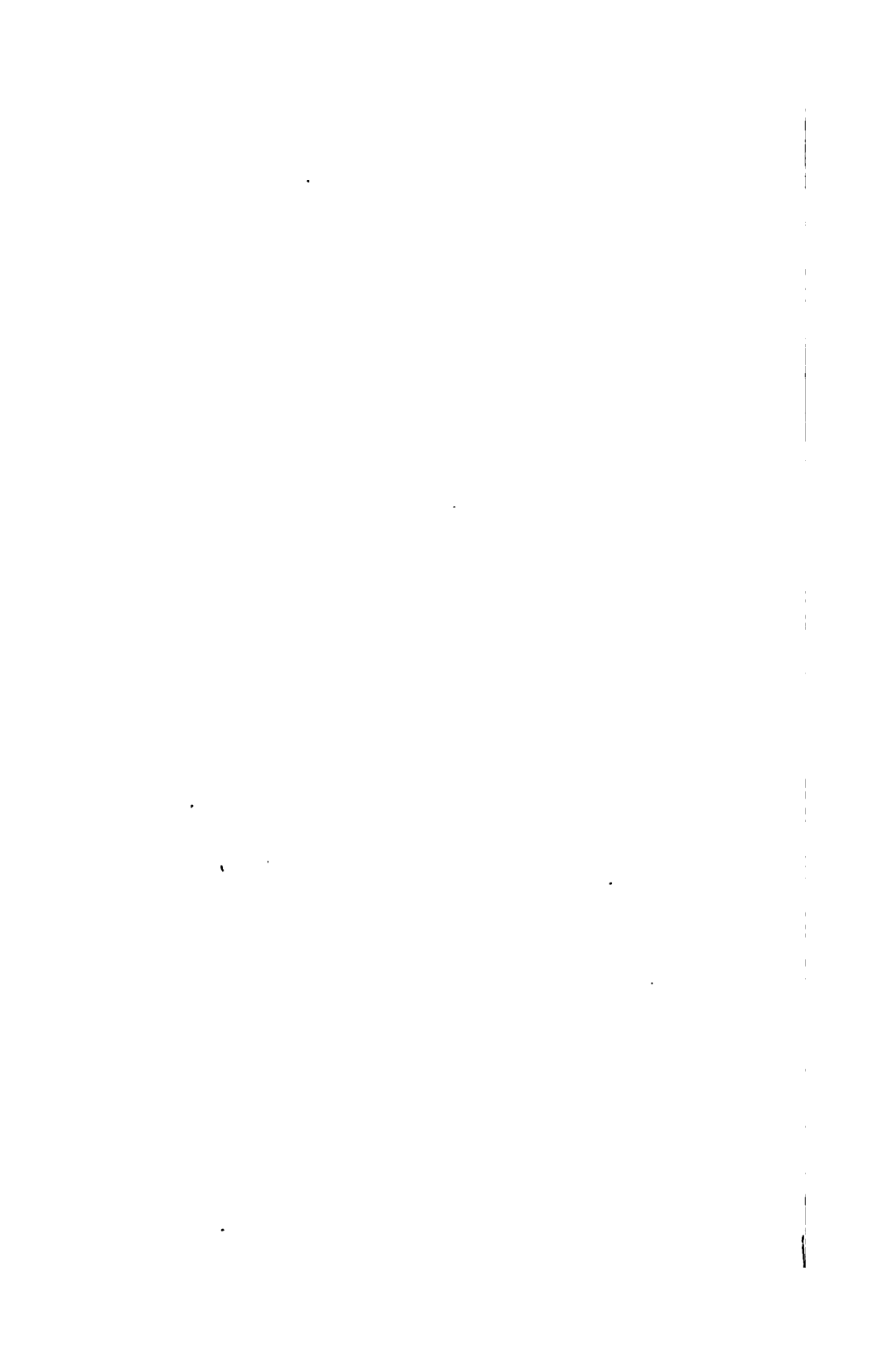


# **THE GARY PUBLIC SCHOOLS**

## **MEASUREMENT OF CLASSROOM PRODUCTS**

*By*  
**STUART A. COURTIS**

**GENERAL EDUCATION BOARD  
61 BROADWAY                      NEW YORK  
1919**



## **MEASUREMENT OF CLASSROOM PRODUCTS**

## **SURVEY OF THE GARY SCHOOLS**

On invitation of the Board of Education and the Superintendent of Schools of Gary, Indiana, a survey of the Gary schools was made by the General Education Board. It is published in eight parts, as follows:

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**THE GARY PUBLIC SCHOOLS**

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## CONTENTS

|                                               | PAGE |
|-----------------------------------------------|------|
| INTRODUCTION . . . . .                        | vii  |
| AUTHOR'S PREFACE . . . . .                    | xxi  |
| I. GENERAL STATEMENT. . . . .                 | 3    |
| II. TESTS AND TESTING CONDITIONS . . . . .    | 10   |
| III. HANDWRITING . . . . .                    | 28   |
| §1. General Results                           |      |
| §2. Critical Discussion                       |      |
| IV. SPELLING . . . . .                        | 79   |
| §1. General Results                           |      |
| §2. Critical Discussion                       |      |
| V. ARITHMETIC . . . . .                       | 146  |
| §1. General Results                           |      |
| §2. Critical Discussion                       |      |
| VI. COMPOSITION . . . . .                     | 209  |
| §1. General Results                           |      |
| §2. Critical Discussion                       |      |
| VII. READING . . . . .                        | 263  |
| §1. General Results                           |      |
| §2. Critical Discussion                       |      |
| VIII. FACTORS AFFECTING PERFORMANCE . . . . . | 355  |
| IX. CONCLUSIONS . . . . .                     | 383  |
| X. APPENDIX A . . . . .                       | 388  |
| XI. APPENDIX B . . . . .                      | 483  |



## INTRODUCTION

### THE GARY PLAN

In the last few years both laymen and professional educators have engaged in a lively controversy as to the merits and defects, advantages and disadvantages of what has come to be called the Gary idea or the Gary plan. The rapidly increasing literature bearing on the subject is, however, deficient in details and too often partisan in tone. The present study was undertaken by the General Education Board at the request of the Gary school authorities for the purpose of presenting an accurate and comprehensive account of the Gary schools in their significant aspects.

In the several volumes in which the main features of the Gary schools are separately considered, the reader will observe that, after presenting facts, each of the authors discusses or—in technical phrase—attempts to evaluate the Gary plan from the angle of his particular interest. Facts were gathered in a patient, painstaking, and objective fashion; and those who want facts, and facts only, will, it is believed, find them in the descriptive and statistical portions of the respective studies. But the successive volumes will discuss principles, as well as

state facts. That is, the authors will not only describe the Gary schools in the frankest manner, as they found them, but they will also endeavor to interpret them in the light of the large educational movement of which they are part. An educational conception may be sound or unsound; any particular effort to embody an educational conception may be adequate or inadequate, effective or ineffective. The public is interested in knowing whether the Gary schools as now conducted are efficient or inefficient; the public is also interested in knowing whether the plan as such is sound or unsound. The present study tries to do justice to both points.

What is the Gary plan?

Perhaps, in the first instance, the essential features of the Gary plan can be made clear, if, instead of trying to tell what the Gary plan is, we tell what it is not. Except for its recent origin and the unusual situation as respects its foreign population, Gary resembles many other industrial centers that are to be found throughout the country. Now, had Gary provided itself with the type of school commonly found in other small industrial American towns, we should find there half a dozen or more square brick "soap-box" buildings, each accommodating a dozen classes pursuing the usual book studies, a playground, with little or no equipment, perhaps a basement room for manual training, a laboratory, and a cooking room for the girls. Had Gary played safe, this is the sort of school and school equipment that it would now possess. Provided with this conventional school

system, the town would have led a conventional school life—quiet, unoffending, and negatively happy—doing as many others do, doing it about as well as they do it and satisfied to do just that.

As contrasted with education of this meager type, the Gary plan is distinguished by two features, intimately connected with each other:

First—the enrichment and diversification of the curriculum;

Second—the administrative device that, for want of a better name, will be tentatively termed the duplicate school organization.

These two features must first be considered in general terms, if the reader is to understand the detailed description and discussion.

As to the curriculum and school activities. While the practice of education has in large part continued to follow traditional paths, the progressive literature of the subject has abounded in constructive suggestions of far-reaching practical significance. Social, political, and industrial changes have forced upon the school responsibilities formerly laid upon the home. Once the school had mainly to teach the elements of knowledge; now the school is charged with the physical, mental, and social training of the child. To meet these needs a changed and enriched curriculum, including community activities, facilities for recreation, shop work, and household arts, has been urged on the content side of school work; the transformation of school aims and discipline

on the basis of modern psychology, ethics, and social philosophy has been for similar reasons recommended on the side of attitude and method.

These things have been in the air. Every one of them has been tried and is being practised in some form or other, somewhere or other. In probably every large city in the country efforts have been made, especially in the more recent school plants, to develop some of the features above mentioned. There has been a distinct, unmistakable, and general trend toward making the school a place where children "live" as well as "learn." This movement did not originate at Gary; nor is Gary its only evidence. It is none the less true that perhaps nowhere else have the schools so deliberately and explicitly avowed this modern policy. The Gary schools are officially described as "work, study, and play" schools—schools, that is, that try to respond adequately to a many-sided responsibility; how far and with what success, the successive reports of the Gary survey will show.

It must not, however, be supposed that the enriched curriculum was applied in its present form at the outset or that it is equally well developed in all the Gary schools. Far from it. There has been a distinct and uneven process of development at Gary; sometimes, as subsequent chapters will show, such rapid and unstable development that our account may in certain respects be obsolete before it is printed. When the Emerson school was opened in 1909, the equipment in laboratories, shops, and museums, while doubtless superior to what

was offered by other towns of the Gary type, could have been matched by what was to be found in many of the better favored larger towns and cities at the same period. The gymnasium, for example, was not more than one third its present size; the industrial work was not unprecedented in kind or extent; the boys had woodwork, the girls cooking and sewing. But progress was rapid: painting and printing were added in 1911; the foundry, forge, and machine shop in 1913. The opportunities for girls were enlarged by the addition of the cafeteria in 1913. The auditorium reached its present extended use as recently as the school year 1913-14. The Froebel school, first occupied in the fall of 1912, started with facilities similar to those previously introduced piecemeal into the Emerson.

These facilities, covering in their development a period of years, represent the effort to create an elementary school more nearly adequate to the needs of modern urban life. The curriculum is enriched by various activities in the fields of industry, science, and recreation. Questions as to the efficiency with which these varied activities have been administered will be discussed by the various contributors to the present study. Meanwhile, it is perhaps only fair to point out that the modern movement calls not only for additions to, but eliminations from, the curriculum and for a critical attitude toward the products of classroom teaching. How far, on the academic side, the Gary schools reflect this aspect of the modern movement will also presently appear.



The administrative device—the “duplicate” organization, noted above as the second characteristic feature of the Gary plan—stands on a somewhat different footing, as the following considerations make plain.

Once more, Mr. Wirt was not the inventor of the intensive use of school buildings, though he was among the first—if not the very first—to perceive the purely educational advantage to which the situation could be turned. The rapidity with which American cities have grown has created a difficult problem for school administrators—the problem of providing space and instruction for children who increase in number faster than buildings are constructed. The problem has been handled in various ways. In one place, the regular school day has been shortened and two different sets of children attending at different hours have been taught daily in one building and by one group of teachers. Elsewhere, as in certain high schools, a complete double session has been conducted. The use of one set of schoolrooms for more than one set of children each day did not therefore originate at Gary.

Another point needs to be considered before we discuss the so-called duplicate feature of the Gary plan. In American colleges, subjects have commonly been taught by specialists, not by class teachers. The work is “departmentalized”—to use the technical term. There is a teacher of Latin, a teacher of mathematics, a teacher of physics, who together instruct every class—not a separate teacher of each class in all subjects. Latterly,

departmentalization has spread from the college into the high school, until nowadays well organized high schools and the upper grades of elementary schools are quite generally "departmentalized," i.e., organized with special teachers for the several subjects, rather than with one teacher for each grade.

Out of these two elements, Gary has evolved an administrative device, the so-called duplicate school, which, from the standpoint of its present educational significance, does indeed represent a definite innovation.

For the sake of clearness, it will be well to explain the theory of the duplicate school by a simplified imaginary example:

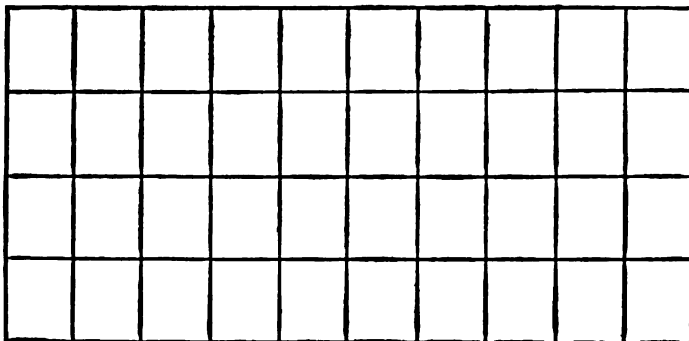
Let us suppose that elementary school facilities have to be provided for, say, 1,600 children. If each class is to contain a maximum of 40 children, a schoolhouse of 40 rooms would formerly have been built, with perhaps a few additional rooms, little used, for special activities; except during the recess (12 to 1:30) each recitation room would be in practically continuous use in the old-line subjects from 9 to 3:30, when school is adjourned till next morning. A school plant of this kind may be represented by Figure I, each square representing a schoolroom.

The "duplicate" school proposes a different solution. Instead of providing 40 classrooms for 40 classes, it requires 20 classrooms, capable of holding 800 children; and further, playgrounds, laboratories, shops, gardens, gymnasium, and auditorium, also capable of holding

800 children. If, now, 800 children use the classrooms while 800 are using the other facilities, morning and afternoon, the entire plant accommodates 1,600 pupils throughout the school day; and the curriculum is greatly enriched, since, without taking away anything from their classroom work, they are getting other branches also. A school thus equipped and organized may be represented

FIGURE I  
REPRESENTS OLD-FASHIONED SCHOOLHOUSE

40 rooms for 40 classes, of 40 children each, i. e., facilities for the academic instruction of 1,600 children. A school yard and an extra room or two, little used, for special activities, are also usually found.



by Figure II, in which A represents 20 classes taking care of 40 children each (800 children), and B represents special facilities taking care of 800 children. As A and B are in simultaneous operation, 1,600 children are cared for.

This method of visualizing the "duplicate" school serves to correct a common misconception. The plan aims to intensify the use of schoolrooms; yet it would be

incorrect to say that 20 classrooms, instead of 40, as under the old plan, accommodate 1,600 children. For while the number of classrooms has been reduced from 40 to 20, special facilities of equal capacity have been added in the form of auditorium, shops, playground, etc. The 20 classrooms apparently saved

FIGURE II  
REPRESENTS THE GARY EQUIPMENT

| A                                                                                                                                                                      | B                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| 20 classrooms for academic instruction of 20 classes of 40 children each (800 children) in the morning hours and an equal number in the afternoon (1,600 in all daily) | Special facilities, taking care of 800 children in the morning hours and an equal number in the afternoon hours (1,600 in all daily) |
|                                                                                                                                                                        | Auditorium                                                                                                                           |
|                                                                                                                                                                        | Shops                                                                                                                                |
|                                                                                                                                                                        | Laboratories                                                                                                                         |
|                                                                                                                                                                        | Playground, gardens, gymnasium and library                                                                                           |

have been replaced by special facilities of one kind or another. The so-called duplicate organization and the longer school day make it possible to give larger facilities to twice as many children as the classrooms alone would accommodate. The duplicate school, as developed at Gary, is not therefore a device to relieve congestion or to reduce expense, but the natural result of efforts to provide a richer school life for all children.

The enriched curriculum and the duplicate organization support each other. The social situation requires a scheme of education fairly adequate to the entire scope of the child's activities and possibilities; this cannot be achieved without a longer school day and a more varied school equipment. The duplicate school endeavors to give the longer day, the richer curriculum, and the more varied activities with the lowest possible investment in, and the most intensive use of, the school plant. The so-called duplicate school is thus a single school with two different types of facilities in more or less constant and simultaneous operation, morning and afternoon.

Such is the Gary plan in conception. What about the execution? Is it realized at Gary? Does it work? What is involved as respects space, investment, etc., when ordinary classrooms are replaced by shops, playgrounds, and laboratories? Can a given equipment in the way of auditorium, shops, etc., handle precisely the same number of children accommodated in the classrooms without doing violence to their educational needs on the one hand, and without waste through temporary disuse of the special facilities, on the other? To what extent has Gary modified or reorganized on modern lines the treatment of the common classroom subjects? How efficient is instruction in the usual academic studies as well as in the newer or so-called modern subjects and activities? Is the plan economical in the sense that equal educational advantages cannot be procured by

any other scheme except at greater cost? These and other questions as to the execution of the Gary plan are, as far as data were obtainable, discussed in the separate volumes making up the present survey.

The concrete questions above mentioned do not, however, exhaust the educational values of a given school situation. From every school system there come imponderable products, bad as well as good. Aside from all else, many observers of the Gary schools report one such imponderable in the form of a spiritual something which can hardly be included in a study of administration and eludes the testing of classroom work. These observers have no way of knowing whether Gary school costs are high or low; whether the pupils spell and add as well as children do elsewhere; but, however these things may be, they usually describe the pupils as characterized by self-possession, resourcefulness, and happiness to an unusual degree. While different schools and indeed different parts of the same school vary in this respect, the members of the survey staff agree that, on the whole, there is a basis of fact for these observations. Gary is thus something more than a school organization characterized by the two main features above discussed.

The reason is not far to seek. Innovation is stimulating, just as conformity is deadening. Experiment is in this sense a thing wholesome in itself. Of course it must be held to strict accountability for results; and this study is the work of persons who, convinced of the necessity of educational progress, are at the same time

solicitous that the outcome be carefully observed. The fact that customary school procedure does not rest upon a scientific basis, does not willingly submit itself to thorough scrutiny, is no reason for exempting educational innovations from strict accountability. The very reverse is indeed true; for otherwise innovation may imperil or sacrifice essential educational values, without actually knowing whether or not it has achieved definite values of its own. Faith in a new program does not absolve the reformer from a watchful and critical attitude toward results. Moreover, if the innovator formulates his purposes in definite terms and measures his results in the light of his professed aims, the conservative cannot permanently escape the same process. Gary, like all other educational experiments, must be held accountable in this fashion. Subject however to such accountability, the breaking of the conventional school framework, the introduction of new subject matter or equipment, even administrative reorganization, at Gary as elsewhere, tend to favor a fresher, more vigorous interest and spirit. Defects will in the following pages be pointed out in the Gary schools—defects of organization, of administration, of instruction. But there is for the reasons just suggested something in the Gary schools over and above the Gary plan. Problems abound, as in every living and developing situation. But the problems are the problems of life, and, as such, are in the long run perhaps more hopeful than the relatively smooth functioning of a stationary school system. Thus, not-

## INTRODUCTION

xix

withstanding the defects and shortcomings which this study will candidly point out, the experiment at Gary rightly observed and interpreted is both interesting and stimulating.





## AUTHOR'S PREFACE

The present account of the measurement of certain products of classroom teaching at Gary presents in detail the results of the various tests given for the purpose of measuring the degree of efficiency with which the common school subjects were taught at the time of the investigation of the Gary schools. Because of the care with which the testing work at Gary was conducted, and the number and variety of the tests given, the data secured seem to the author to have thrown much light upon some of the problems fundamental to all measurement work. He believes that the testing movement has now reached a stage in which a critical study of the validity of the results secured may be both interesting and beneficial. Accordingly, he has ventured to discuss at considerable length in Section 2 of each chapter the technique of classroom testing and the various factors which affect the results. The report ought, therefore, to be of interest not only because it deals with Gary, but because it attempts a general critical discussion of tests and testing.

A volume of this character is never the product of a single mind. The writer would be ungrateful indeed did he not acknowledge his indebtedness for the great

and varied assistance he has received: First and foremost, to the superintendent, teachers, and pupils of the Gary schools, without whose fullest coöperation the thoroughness of the testing work could not have been attained; to Messrs. Ayres, Thorndike, and Judd, for aid in the interpretation of the data secured; and finally, and perhaps most of all, to the enthusiasm, disinterested service and fidelity of the six young men who served as his assistants, Messrs. Paul C. Packer, E. J. Ashbaugh, George C. Brandenburg, Leo J. Brueckner, J. W. Richardson, and E. H. Lauer. It is through their arduous labors, intelligent coöperation, conscientious performance of assigned tasks, that the original design of the survey has been carried out as planned.

For such errors in planning, execution, and expression, as may be found, the writer accepts full responsibility. They indicate merely his limitations and his inability to profit fully by the generous and loyal assistance which all have been glad to give.

## **MEASUREMENT OF CLASSROOM PRODUCTS**



## I. GENERAL STATEMENT

### STATUS OF EDUCATIONAL MEASUREMENT

**T**HROUGHOUT this report the reader will need to keep constantly in mind the fact that educational measurement is a recent development. The first reliable scale for measurement of any educational product was published early in 1910; measurement was first used in a large modern survey in 1912. Even to-day there are probably hundreds of educational workers who have never heard of measurement, and hundreds more who have not the faintest conception of the fundamental principles involved.

On the other hand, so rapid has been the development that a bureau for educational research was established in a city school system by September, 1913. To-day there is a National Association of Directors of Educational Research with a membership of thirty-odd men and women who are giving their time wholly, or mainly, to such work. Courses in educational measurement are given in most university schools of education and in many normal schools. No survey of a school system would to-day be attempted without making provision to secure objective evidence through educational measurement upon which to base conclusions.

However, the mushroom growth of the movement for measurement, the superficial use of untested tools, the hasty generalization from insufficient data do not make for confidence. There is at the present moment a very great danger that educational measurement will be discredited more by the reckless optimism of its friends than by the attacks of its enemies. Yet of the value of measurement itself there can be no question; the methods of science are not on trial. There is no question, even, of the applicability of methods of scientific measurement to educational problems. The one thing that is needed is time, time to study the measuring instruments themselves before accepting them as perfect, time to formulate fully a problem before attempting to solve it, time to gather reliable data and to digest them before arriving at conclusions.

#### LIMITATIONS OF MEASUREMENT

In the appraisal of educational innovations the ultimate question must ever be: "What is the effect upon the children?" However widely a school system may depart from established usage, however much its experimental modifications of either theory or practice may seem injudicious and undesirable, if it could be shown by impersonal, objective measurement that because of the changes that had been made, the graduates of the school system in question are better developed, better trained, and generally more desirable members of society, all other judgments would have to be reversed.

Unfortunately, it is not possible at the present time to measure completely and objectively the total educational product of a school system. For many years to come, expert opinion based upon inspection must be our only means of estimating the general worth of such educational experiments as that at Gary. But in certain phases of school work measurement is possible, and such measurement serves as a check upon the observations and opinions of the inspecting experts. If, for example, inspection is made of the teaching of spelling and such teaching is judged to be faulty, while the objective tests of spelling ability prove that the children spell very much better than children of the same grade or age in conventional school systems, then the ability of the judges to pass upon the innovations may well be doubted. If, on the other hand, the results of the objective tests and the subjective opinion of the inspectors are in complete agreement, then the judgments of the experts in those matters in which no such checks are at present possible may be accepted with greater confidence. Educational measurement in its present stage of development must necessarily deal with but few of the many products of educational work. It is more valuable as a check upon the more extended (but less reliable) subjective judgments of a survey staff than as a complete and independent determination of the merits or demerits of a school system. Therefore, this report should be read and interpreted in connection with that on Organization and Administration, and the chapters, in *The Gary Schools*:



A General Account, dealing with the Course of Study and Instruction.

TITLE

The title chosen for this report calls for explanation. Measurement itself is so new, the total of our scientific knowledge of tests and testing so meager, that in spite of the limitations implied in the use of the word "certain," the title "Measurement of Certain Products of Classroom Teaching" is still too sweeping in its claims. Any ordinary writing lesson may awaken the dormant self-consciousness of a child to a sense of his own power, the mastery of a spelling difficulty may strengthen the fibers of his character, the deadliest grind found in the most mechanical school may, for certain individuals, serve to organize and direct their energies toward worthy aims. Stimulation, character building and inspiration may be products of classroom teaching of the common branches no less than the grosser elements really measured by our educational tests. When, therefore, we undertake to measure classroom products and measure only efficiency in certain mechanical abilities we may miss wholly certain other products of equal or greater value. If all the ideas, which a strict regard for the truth would require, were to appear in the title, a statement something like the following would have to be used: "A report of an attempt to measure a few phases of certain products of classroom teaching in four of the largest public schools at Gary." The shorter title should be so read as to connote the longer.

Yet, after all, it may be that the shorter title does not so culpably misrepresent the truth. True stimulation awakens a child to his school opportunities no less than to those of the outside world. True character building is made manifest by the spirit in which daily tasks are performed, whether these tasks are in the school or in the home. True inspiration produces as substantial achievement in childhood as in the prime of life. Therefore, when measurement of the higher phases of the products of classroom teaching becomes possible, it may be that we shall find the higher and the lower so indissolubly linked together that from the measurement of one, the degree of development of the other may be inferred. The present study is, at least, an honest attempt to evaluate completely and thoroughly those elements in the situation which are now measurable.

#### RELIABILITY

Because the dangers and limitations of measurement were fully recognized, the attempt was made at Gary to secure results as reliable as it is possible to make them at present. Each subject was tested in more than one way, and great care was taken to control the conditions under which the tests were given and scored. Tests of the product of teaching of the elementary schools were carried through the high school grades as well, both to determine how the abilities developed in the lower grades were affected by high school work, and to see whether or not any marked changes in product had

occurred in recent years. From the point of view of thoroughness, therefore, and within their narrow field, the results are probably more complete and hence more reliable than those of previous surveys.

#### PLAN OF REPORT

No effort, time, or expense has been spared on this report. And yet, as the time comes for publication, there comes also the realization that what has been written may very easily be misunderstood. A survey report to be readable must condense and summarize its findings, but to be intelligible must give in full the data upon which its conclusions are based. Either course alone is sure to lead to misconception. Accordingly, the writer has written this report in three sections. Section 1 of each chapter is a concise, non-technical discussion of the significant aspects of the data secured in the present attempt to evaluate by measurement the effects of the Gary system upon the teaching of the fundamental branches in the Gary schools. Section 2 contains critical discussions of all that is involved in the testing process—analyses that will show clearly the reservations with which any set of conclusions should be put forward. Finally, in the appendices has been placed material of value to the student of education and essential to a careful study of the report, but devoid of interest except to the specialist. This material includes certain of the longer detailed tables, directions for scoring the tests, samples of record sheets, score cards, and other items of a similar nature.

## INTERPRETATION

In interpreting the meaning of results of tests, three methods of procedure are possible. One method—and the best, for it is the least ambiguous—is to state what was found, leaving it to the reader to judge for himself whether or not the product is satisfactory. The second method is to compare the results obtained with those from other cities where similar measurements have been made. This method is legitimate only when the two cities have been measured with equal care and under similar conditions. The third method is to record the investigator's own conclusions. This method is the most dangerous, for it is difficult to free opinion from the effects of personal bias. However, in this report all three methods have been followed. In succeeding chapters the direct and comparative data will be found in detail. In the final chapter the author's own conclusions from these data are presented.

## II. TESTS AND TESTING CONDITIONS

**T**HE theory of the modern program at Gary, aiming to minister adequately to every need of the child—physical, intellectual, moral, industrial, and social—and to correlate closely school activities with those of real life, meets with general approval; but the vital question to be answered by the measurements described in this volume is: What effects do the actual ways in which the Gary schools carry out their program have upon certain educational products?

### THE SCHOOLS TESTED

The four most representative schools of Gary, named in the order of size and equipment, are: Froebel, Emerson, Jefferson, and Beveridge. The Froebel and Emerson schools, built within the last ten years, are both architecturally adapted and fully equipped to carry out an extended and enriched program. The Jefferson and Beveridge schools, however, were in existence prior to the development of the present system. In both, in spite of alterations, the attempt to carry out the full implication of the Gary plan is handicapped by limitations of equipment. Nevertheless, both have the longer school

day and the new type of organization, and in both the regular academic work is supplemented by such additional special work as their facilities permit. Comparisons from one Gary school to another are thus possible and should serve to bring to light any effects caused by differences in equipment or organization.

The remaining schools are small in size, limited in equipment, and at such distances from the center of the town that it seemed better to confine the testing to the four schools mentioned. Accordingly, but few tests were given in the small schools.

#### SOCIAL CONDITIONS

The sections of the city served by the various schools differ greatly in social conditions; hence, in making school to school comparisons these differences should be kept in mind. The Froebel children are mainly of foreign parentage and often come from homes far down on the social scale. As a result, difficulty with language is a factor which enters largely into all work at this center. The Emerson and Jefferson schools, however, draw from the better residential districts. Beveridge is in an older and poorer section of the city, and its children differ accordingly. The differences in the home conditions from school to school are, therefore, marked.

In regard to the related question as to the composition of the population, it is probable that the foreign born element in Gary is greater than in most American cities

of the same size, but probably not greater than in other rapidly growing industrial centers.<sup>1</sup>

#### SYSTEM OF GRADING

The regular school year in Gary is ten months, usually divided into three equal terms. There is a corresponding division of grades into A, B, and C groups. Thus the lowest group in the sixth grade is known as 6C, the next higher as 6B, and the highest group as 6A. However, all three divisions are often found in the same class organization, taking the same work.<sup>2</sup> But class organization is not as stable at Gary as in conventional systems.<sup>3</sup> Children tend to come and go, and the membership of a given class fluctuates correspondingly. In conducting a test it has happened that the grade label given by the principal to a class did not agree with that given by the teacher, and sometimes neither was the same as the grades written by the children on the test papers. Under the circumstances, it was decided to give to each class the official grade assigned to it at the

<sup>1</sup>See The Gary Schools: A General Account.

<sup>2</sup>It might have happened that this plan of promotion would make comparisons with corresponding grades in other cities unfair, in that a third of the children would have been in a grade but a short time by the end of the year. Careful checking of the data, however, proves that owing to the manner of grouping children in classes, this is not the case; the special condition is favorable to Gary rather than otherwise.

<sup>3</sup>The various recitation groups or classes are numbered, as class 18, Jefferson. Two classes of the same grade in the same school have different numbers. Thus class 45, Froebel, is an eighth grade class, and class 46 is also an eighth grade class.

close of school before promotions in June, 1916. Class No. 45 Froebel, for instance, will be called an eighth grade class, and throughout the tables that follow its scores form a part of the eighth grade group.

#### ATTENDANCE

Class No. 45 was a persistent unit throughout the testing period and has been so tabulated, but the individuals comprising class No. 45 varied more or less with every test. The actual number of individuals found in this class on the 20 different occasions on which it was visited from March 23 to June 9 varied from 11 to 23 (Figure 1). While this particular class illustrates extreme variation above and below the official class membership, similar data were obtained for many other classes.<sup>1</sup>

The irregularity in class No. 45 Froebel was due to many causes; some of the variations were brought about by such legitimate factors as sickness and withdrawal from school work; other cases represent legitimate variations caused by adjustment of programs to individual needs leading to attendance on other than official classes. For instance, individual "I" (Figure 1) on April 11 recited for some reason with class No. 46 instead of with class No. 45 in which he officially belonged. Simi-

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<sup>1</sup>The results for the other 4 eighth grade classes (combined) are: official membership 128, maximum attendance 134, minimum 91, median 119; names not on official list, 11; children tested twenty times in the twenty test days, 34 per cent. See also Table I, Appendix A.



## THE GARY SCHOOLS

FIGURE 1  
CHILDREN ACTUALLY TESTED IN CLASS NO. 45 FROEBEL

| ATTENDANCE-FROEBEL-CLASS 45- EIGHTH GRADE |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    |       |                     |
|-------------------------------------------|-----|----|----|-------|----|----|----|----|----|----|-----|----|----|----|----|----|----|------|----|----|-------|---------------------|
| NAME                                      | MAR |    |    | APRIL |    |    |    |    |    |    | MAY |    |    |    |    |    |    | JUNE |    |    | TOTAL | REMARKS             |
|                                           | 23  | 30 | 4  | 11    | 13 | 14 | 25 | 26 | 27 | 2  | 4   | 10 | 11 | 16 | 18 | 29 | 31 | 1    | 8  | 9  |       |                     |
| A                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 16    |                     |
| B                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 6     | ENROLLED IN 44 N    |
| C                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 2     | NOT ENROLLED        |
| D                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 20    |                     |
| E                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 19    |                     |
| F                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 13    |                     |
| G                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 16    |                     |
| H                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 15    |                     |
| I                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 17    | APRIL IN 44         |
| J                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 3     | NOT ENROLLED        |
| K                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 1     | WITHDRAWN 44        |
| L                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 7     | NOT ENROLLED        |
| M                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 20    |                     |
| N                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 2     |                     |
| O                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 18    |                     |
| P                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 16    |                     |
| Q                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 20    |                     |
| R                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 16    |                     |
| S                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 2     | ENROLLED IN 44 N.T. |
| T                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 20    |                     |
| U                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 12    |                     |
| V                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 14    |                     |
| W                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 19    |                     |
| X                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 19    |                     |
| Y                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 1     | TESTED IN 44-46     |
| Z                                         |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 2     | ENROLLED IN 45 Y    |
| TOTAL                                     | 23  | 21 | 19 | 18    | 15 | 15 | 17 | 13 | 13 | 15 | 15  | 15 | 15 | 15 | 14 | 13 | 13 | 17   | 11 | 13 | 311   | VARIATION-1123      |
|                                           |     |    |    |       |    |    |    |    |    |    |     |    |    |    |    |    |    |      |    |    | 61%   | MEDIAN 15           |

Individuals are denoted by letters in the column at the left. The dates of the various tests are given at the top. Each small rectangle represents the attendance of one individual for one day. Black means absence. Abbreviations have the following meanings:

T means tested in the given class.

N. T. means not tested in the given class.

46 means class No. 46, also eighth grade class.

44 means class No. 44, a seventh grade class.

43 means class No. 43, a seventh grade class.

Withdrawn means left school.

Enrolled or not enrolled refers to the "Official lists."

The official enrollment for class No. 45 was 16, the median attendance 15, the maximum attendance 23, the minimum 11, the number of different individuals found in the class during the twenty test days, 26. The superintendent states that this class was a small, irregular group which served as a temporary "catch all" for the grade. However, similar variations were found in other classes and grades, also.

larly, individual "Z" was regularly tested in class No. 43 (7th grade), his official class, but twice appeared in class No. 45 (8th grade). Individual "B" appears on the official list<sup>1</sup> of class No. 46 and individual "S" in class No. 44, but neither is found in the records of the tests of these classes. Individuals "C," "J," and "L" represent still another type of variation; their names do not appear on any of the official lists of any classes yet their test papers are on file as proof that on the days mentioned they were present in class No. 45. In grades four to eight, for 51 classes with an average membership of 31, there were found present for the spelling test on May 2 and 3, on the average, 1.7 names per class which did not appear on the official enrollment.<sup>2</sup> That is, the tests were given to continually fluctuating groups.

No complete tabulation of the exact attendance by individuals in each test and class was made, because a

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<sup>1</sup>Principals were asked to furnish complete lists by classes of all the children enrolled. Previously, children's names appearing on the teachers' registers had been copied on cards, and checked against the promotion lists for grades and against the census reports for age. When the lists furnished by the principals had been checked against these cards, they were adopted as "Official Class Lists" and are so referred to throughout this report.

<sup>2</sup>Percentage of "extra" pupils: Froebel, 7.5%; Jefferson, 6.5%; Emerson, 2%; Beveridge, 1%. There is some evidence tending to show that the "extra" pupils were present in larger numbers when the testing work was new. Whether the absent and extra groups represent real conditions or simply defects in the "official lists" cannot be determined. The "official lists" represent, at least, the best that could be done with such lists as the principals furnished.

## THE GARY SCHOOLS

TABLE I  
 Amounts for the Various Funds for 1907 for the City of Gary

| Name        | Amount |      | Total | Total | Total | Total |
|-------------|--------|------|-------|-------|-------|-------|
|             | 1907   | 1908 |       |       |       |       |
| Municipal   | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
| School      | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
| City        | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
| County      | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
| State       | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
| Federal     | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
| Total       | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
| Grand Total | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |
|             | 224    | 224  | 448   | 448   | 448   | 448   |

# TESTS AND TESTING CONDITIONS

17

|                 |    |      |    |     |       |       |    |
|-----------------|----|------|----|-----|-------|-------|----|
| May             | 2  | 80.1 | 48 | .11 | 1,477 | 1,306 | 88 |
|                 | 3  | 29.9 | 50 | .18 |       |       |    |
|                 | 4  | 29.9 | 55 | T   | 1,477 | 1,311 | 89 |
|                 | 5  | 29.8 | 53 | O   |       |       |    |
|                 | 11 | 29.9 | 60 | O   | 1,436 | 1,231 | 86 |
|                 | 16 | 29.7 | 50 | T   | 1,430 | 1,233 | 86 |
|                 | 18 | 29.9 | 52 | O   | 1,477 | 1,257 | 85 |
|                 | 19 | 29.9 | 55 | T   |       |       |    |
|                 | 29 | 29.8 | 63 | .47 | 1,477 | 1,169 | 79 |
|                 | 31 | 30.1 | 57 | O   | 1,477 | 1,231 | 83 |
| June            | 1  | 29.9 | 68 | T   | 1,453 | 1,159 | 80 |
|                 | 8  | 29.4 | 55 | .64 | 1,412 | 962   | 68 |
|                 | 9  | 29.6 | 58 | .06 | 1,453 | 1,098 | 76 |
| Average 19 days |    |      |    |     |       |       | 83 |

\*Based on reports of U. S. Weather Bureau for Chicago. As Gary is in the Chicago district, no local records were available.

Whenever possible, the giving of any test was completed in one day. If but one or two classes were tested on a second day, only the first day appears in the table. Whenever several classes were tested on the second day, both days are given. See I of Appendix A.

May 10th, included in Figure 1, was omitted from Table I, because the testing conditions proved unsatisfactory.

study of attendance, as such does not fall within the scope of this report; but plenty of incidental evidence that Figure 1 actually reflects conditions throughout all grades of the school during the testing periods has been accumulated during the process of checking records. For instance, the actual number of children tested on the 19 test days varied from 68 per cent. to 90 per cent. (average 83 per cent.) (Table I, Figure 2). The writer estimates that about 80 children out of 100 enrolled were tested regularly,<sup>1</sup> that the remaining children varied from day to day. As part of either the constant or fluctuating group, there were approximately 5 per cent. of the children who were either not enrolled at all, or who, from causes legitimate or otherwise, recited from day to day with classes other than their own. On the average, therefore, a single test measures only 83 per cent. of the total number of children enrolled.

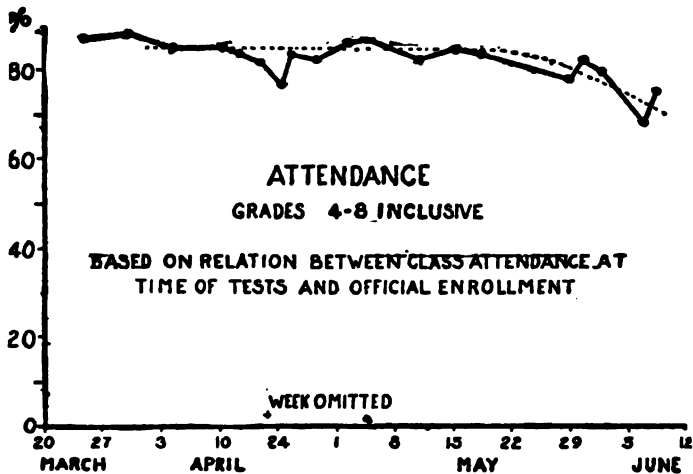
#### COURSES OF STUDY, TIME ALLOTMENTS

An important series of facts bearing directly upon the interpretation of the results of tests are those connected with the amount and character of the instruction, with

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<sup>1</sup>That is, three days out of four. For instance, the four Trabue Language Scales were given at Gary as follows: B, April 13; D, April 14; E, May 16; C, May 29. A class selected at random from the Emerson school proved to be class No. 12, 6th grade. From the tests, 43 names were secured (official membership, 38); 49 per cent. of these children were present for all four tests, 26 per cent. for three tests, 11 per cent. for two tests, and 14 per cent. for one test only. Approximately 55 per cent. of the official membership were present for all four tests.

FIGURE 2  
PERCENTAGE OF ATTENDANCE AT TIME OF TESTS FROM MARCH TO JUNE



The scale along the base of the figure is the time scale. The scale along the vertical axis represents the per cent. the actual attendance is of the official enrollment. The solid line represents the results obtained. The dotted line is the generalized<sup>1</sup> curve of attendance. The general percentage of attendance indicated by the dotted line is 85%.

The reader should note that in the time scale a week during which there was no school has been omitted.

<sup>1</sup>See XI of Appendix A, page 474.

the amount and conditions of study, and with the relation of the special work to the academic training. For detailed information on these points the reader is referred to the other survey reports.

#### TESTING PROGRAM<sup>1</sup>

The testing period extended from the third week in March to the end of the second week in June (Figure 2). The subjects covered were reading, writing, arithmetic, English composition, and spelling. Counting each separate test and each repetition of the same as one, the total number of tests given was 55, and the total number of papers scored and tabulated 69,282. With one or two minor exceptions, only well established standard tests were used (Figure 3) and these only in the fundamental subjects taught in the elementary grades.

#### TESTING CONDITIONS

The effort was made to complete in one day the giving of each test to the entire city. Owing to the departmentalization of school work, however, and the lack of facilities for testing large groups at one time, it was necessary to reach classes in particular rooms where conditions were suitable, so that in some cases a few of the classes had to be tested on the day following the general test. The children were not all tested at the same hour of the

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<sup>1</sup>See Table II, page 393, of Appendix A for a complete statement of the days upon which tests were given.

day, but experimental investigations<sup>1</sup> seem to show that the time of day is not a factor in determining results. The fatigue arising from routine work disappears before

FIGURE 3  
TESTS GIVEN AT GARY

|                       |                      |                 |
|-----------------------|----------------------|-----------------|
| READING               | WRITING              | ARITHMETIC      |
| Oral                  | Cleveland            | Series B        |
| Gray                  | Free-choice          | Four Operations |
| Silent                | Dictation            |                 |
| Kansas                |                      | Cleveland       |
| Courtis               | Composition          | Multiplication  |
| Trabue                |                      | Fractions       |
| ENGLISH COMPOSITION   | SPELLING             |                 |
| Original Story        | Cleveland List Tests |                 |
|                       | Dictation Tests      |                 |
| Reproduction of Story | Composition Test     |                 |

Total 55 Tests—69,282 Papers.

the stimulus of a change of work and the new situation. At any rate the Gary results should not be affected by this factor more than the results from tests in other school systems. In general, the tests were given on Tuesdays and Thursdays, although a few exceptions occurred. Any one class within the grades tested was visited from 19 to 23 times.<sup>2</sup>

The conditions as to light, heat, materials, etc., under which the tests are given constitute an important group of factors. These are only partially under control and differ greatly from day to day. However, they differ no more for the testing work than for the regular school work. The tests were given in regular classrooms, the children used their usual pens and ink, or pencils, and

<sup>1</sup>See: Heck, W. H., *Journal of Educational Psychology*, Vol. V, page 92.

<sup>2</sup>See discussion of Table II, Appendix A, page 394.



sat at their usual desks. No unusual conditions were noted. One or two classes, mainly in the lowest grades, were tested in rooms with unfavorable desk conditions, but, when necessary and possible, adjustment of rooms was made to provide the children with suitable desks and suitable tools with which to work. However, in general, particular care was taken to test the children during periods when they were already engaged in academic work, that there might be as little disturbance as possible in changing from one type of work to another. That is, the children were not called in from the playground or from their shop work to be tested. The results secured cannot justly be attributed to unusual conditions of this character.

The manner in which tests are given is a factor determining the degree of response made by the children, and an exceedingly difficult factor to control. A child tested for the first time by a stranger may be thrown into a nervous panic which absolutely inhibits intelligent response to the test situation, although ordinarily the number of such cases does not exceed 10 per cent. of the group at most. Again, the exigencies of the testing work require adjustment of instructions and explanations to the varying conditions which arise in classes of different grades and at different hours of the day. In general, the tests were given by the author and his three assistants,<sup>1</sup>

<sup>1</sup>Messrs. Packer, Ashbaugh, and Brandenburg. Mr. Brueckner, Mr. Lauer, and Mr. Richardson assisted in the scoring and tabulations, and all had a part in the preparation of the report.

all of whom are men professionally interested in measurement and experienced in giving tests to school children. For some of the tests, however, it was necessary to use many more than four examiners. Through the kindness of Professor Judd, graduate students were secured as needed from the classes in the University of Chicago. These were given the necessary specific training the day before they were used as examiners. Every effort was made through frequent conferences and direct training to keep conditions uniform.

Particular care was given to the timing. Whenever possible the examiners used automatic timers, consisting of a clock with electrical connections so arranged that it could be set to give automatically the starting and stopping signals. For long or very short intervals, stop-watches and foot-ball timers were used. In many cases the teacher was given a timer also and asked to check the examiner's timing. The variations noted were small and often due to the difference in the reaction times of teachers and examiners. For the most part, the timing was satisfactorily done and the errors kept within 2 per cent. of the total time interval. Only one gross error in timing was discovered and the results for that test and class were rejected. Variation in timing as an explanation of scores was thus reduced to a negligible factor.

Previous to the survey, very little measurement work had been done in the Gary schools. To accustom the children to the taking of tests and to the examiners, as well as to give the members of the staff an opportunity

to become acquainted with the buildings and the intricacies of the program and organization, the first three days were devoted to very simple psychological tests which could have no disturbing meanings to the children. The first day a test on copying figures was given and scored. The children were allowed to examine fully the test itself and the timing device. They scored each other's papers. The second day three trials of the same test were given, one after the other. The third day's work began with a test in canceling triangles, next the fifth trial of the test in copying figures was given, then a second trial of the test in canceling triangles. By this time the children understood the nature of the work, were fully adjusted to such details as starting together, turning over papers rapidly, and stopping promptly on signal. It may be said that the Gary results are too high because of this special preparation, but no part of low scores can justly be attributed to undue nervousness at being timed, or to undue fear of the tests themselves.

One factor, the effect of which it is difficult to evaluate, is the disturbance caused by the survey itself. Teachers were subject to inspection, tests, questionnaires, etc., for a period of several months, and such experiences are not conducive to whole-hearted teaching effort. As far as the testing work itself is concerned, the disturbance and loss of time were small<sup>1</sup> and probably

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<sup>1</sup>Allowing an average disturbance of 25 minutes per test day for 24 days, the total time taken for tests amounts to 10 hours. During the

more than offset by the stimulating effects of repeated measurement upon both teachers and children.

The children seemed to enjoy the tests and frequently expressed the confident opinion that they had done well. The teachers and principals were interested also, and from the superintendent down to the children themselves there was full coöperation. There is every reason to believe, therefore, that the results secured represent fairly the work of the children, and, subject to the general qualifications to be made in Chapter VIII, constitute a fair measure of the children's abilities at the time the survey was made.

#### SCORING

Whenever possible, the tests were scored by the children in duplicate (that is, by two individuals) and later the scoring was checked by the examiners. It should be particularly noted, however, that in every case the original work was unmarked by the children, the scoring being done upon specially prepared answer cards. Most of the original material is still on file, unmarked, just as it came from the children. This made repeated scoring possible so that errors caused by faulty work have been almost completely eliminated.<sup>1</sup> Where-

same period, 165 hours (55 days, 3 hours a day) were allotted to regular work in the subjects tested. That is, the testing work at most decreased the regular classroom instruction by 6 per cent. during the actual time the tests were being given (11 weeks), and by less than 2 per cent. if the entire year is taken as a base.

<sup>1</sup>In spite of every precaution, a few minor errors are discovered at each rereading of data or proof.

ever the scoring involved more judgment than merely checking answers right or wrong, it was done entirely by members of the staff, and then often only after suitable training on standardized material. Special care was taken in scoring all eighth grade papers. The data given in the tables which follow may, therefore, be depended upon to represent correctly the actual results secured.

#### TABULATIONS

Tabulation was carried on by paid, specially trained assistants. For the most part, these were students of the Detroit Normal School, members of the author's own classes in educational measurement. Every care was exercised to check each result. In the general tables, however, fractions and small irregularities have been ignored. The results are correct only to the nearest tenth of an example, or to the nearest whole per cent. For the general discussions, curves have been smoothed, approximations used, and conclusions drawn from general tendencies rather than from minor irregularities. However, in the technical discussions, precise and detailed information is also given.

#### CONCLUSION

From the foregoing paragraphs it should be evident that the work of the most representative Gary schools was measured with due regard to proper control of essential conditions, and that equal care has been taken

in scoring and tabulating the results.<sup>1</sup> In the succeeding chapters, in which the data are presented, little further reference to these phases of the testing will be made.

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<sup>1</sup>For a full discussion of this topic see Part II of the Seventeenth Yearbook of the National Society for the Study of Education (1918), particularly Chap. II.

### III. HANDWRITING

#### §I. GENERAL RESULTS

**H**ANDWRITING has long held a prominent place in American schools. At Gary the annual time allotment is 329 hours, or 7 per cent. of the total time given to the fundamental subjects. For fifty American cities the corresponding average allotment is 388 hours, which is also 7 per cent. of the total.<sup>1</sup> Gary, therefore, is typically American in the emphasis put upon this school art.

#### SECURING AND SCORING SAMPLES

Samples of children's handwriting in grades 2 to 12 were secured in three different ways. The tests used were the Cleveland Free Choice Test, the Courtis Dictation Tests, and the Composition Test.<sup>2</sup> These were all given by the special examiners. The teachers took no part in the testing, although they were present in the rooms at the time the tests were given.

The various samples were measured as to the two most fundamental characteristics of handwriting: rate, or number of letters written per minute; and quality (general merit) as determined by comparison with the Ayres Handwriting Scale. However, to free the results from any pos-

<sup>1</sup>See *The Gary Schools: A General Account*.

<sup>2</sup>For the meaning of these terms, see pages 48 to 53 of this book.

sible question as to the reliability of such scoring they will be presented first by means of representative samples.

Sample "A" (Figure 4, facing page 30) represents the characteristic end product of the training in the elementary grades. It is the writing of an eighth grade child in the free choice test, was written at the rate of 122 letters per minute, and is judged to be equal to quality 45 on the Ayres Scale. It represents approximately the median score<sup>1</sup> made by the entire eighth grade group (generalized eighth grade city wide score: free choice test, 44 Ayres; composition, 42 Ayres; dictation, 39 Ayres)<sup>2</sup>; that is, about half the eighth grade children at Gary wrote as well as, or better than, this sample, half wrote as poorly as, or worse than, this sample. The reader thus has the opportunity of judging for himself whether or not this performance under the test conditions represents a satisfactory result of eight years' training in writing.

<sup>1</sup>The median is the mid-score, a score such that there are as many scores the same or larger as there are the same or smaller. More precisely, it is "that point on the scale of the frequency distribution on each side of which one-half of the measures fall." (Rugg.)

An approximate method has been used in computing the medians in this report. This method yields correct results when the total number of scores is even; but when the total number of scores is odd, the result is in error (too large) by  $\frac{1}{2n}$  th of a step, when "n" represents the frequency in which the median falls.

Throughout the report the non-technical reader may read "average" for "median" without serious error and with no change in the general thought expressed.

<sup>2</sup>For actual median quality, see Table XV, page 75. The best score made by any eighth grade class in any writing test was 48 Ayres, the lowest, 35 Ayres.



Two other examples, also from the free choice test, will serve to define further the quality of writing (Figure 5, page 31). Sample "B" represents writing of the quality (55 Ayres) that is equaled or exceeded by but 12 per cent. of the eighth grade children, while sample "C" represents the quality of writing (30 Ayres) which is equaled or exceeded by 94 per cent. of the eighth grade children. In other words, most (82 per cent.) of the eighth grade writing falls between qualities "B" and "C." If the values were to be based on any one test, the quality of the samples would need to be changed somewhat, but in no case would the change amount to more than half a step on the Ayres Scale.

The same samples may be used to extend the illustration to other grades. For instance, in the composition test<sup>1</sup> the writing of but one twelfth grade student in four equals or exceeds the quality of sample "B," while the writing of but one twelfth grade student in twenty is as poor as, or worse than, sample "C." That is, approximately 75 per cent. of the twelfth grade writing falls between samples "B" and "C." In similar fashion, approximately 45 per cent. of the fourth grade writing falls between samples "A" and "C." Half of the fourth grade writing is worse in quality than sample "C."

The generalized city wide median scores<sup>2</sup> for both

<sup>1</sup>See page 76.

<sup>2</sup>For explanation of the sense in which these terms are used see XI of Appendix A, page 472.

FIGURE 5  
SAMPLES SHOWING THE RANGE IN QUALITY IN THE DIFFERENT GRADES  
SAMPLE B

Four score and seven years ago our  
fathers brought forth upon this country this  
continent a new nation, conceived  
in Liberty and dedicated to the pro-  
position

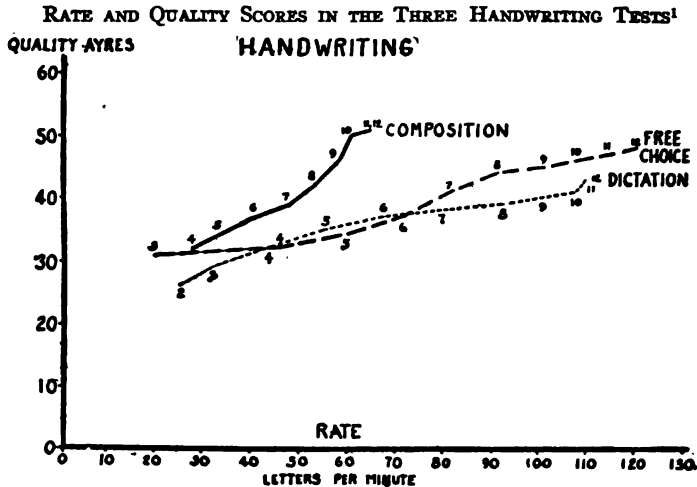
SAMPLE C

Four score and seven years ago our fathers  
brought forth upon this continent a new nation,  
conceived in Liberty and dedicated to the prop-  
osition that all men are created equal. Now we

Samples "B" and "C" are both taken from the papers written by the eighth grade. Sample "B" equals quality 55 on the Ayres Scale; sample "C" represents quality 30 on the Ayres Scale. Approximately 80 per cent. of the eighth grade writing, and 75 per cent. of the twelfth grade writing would be in quality neither worse than sample "C" nor better than sample "B." Forty-five per cent. of the fourth grade writing would in quality fall between samples "A" and "C." The writing of half the children in the fourth grade was as poor as, or worse than, Sample "C."

## THE GARY SCHOOLS

FIGURE 6



The scale along the base of the figure represents rate of writing, or letters written per minute. The scale along the vertical axis represents quality on the Ayres Scale. The heavy solid line represents median scores in the composition test; the heavy broken line, the scores in the free choice test; the dotted line represents scores in the dictation test. The positions of the various grade medians are indicated by figures along the curves.

The graph shows that the free choice and dictation tests agree closely in both rate and quality; that the composition test was written at a much lower rate and with somewhat higher quality than the other tests.

rate and quality of writing in all three tests (Table II, page 33, Figure 6, above) show that the quality of writing at Gary varies from 32 Ayres in the fourth grade to a maximum quality of 51 Ayres in the twelfth grade. The progress in rate of writing is marked in the free-

<sup>1</sup>See Table II, page 33.

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The sample received a score of 55 Ayres, in the com-  
 of handwriting of 130 eighth grade papers in this test,  
 the free choice mark (45 Ayres) and 29 which were  
 be quality 45 papers were marked 35 Ayres or lower, 21  
 ent judges were making conclusions on all the writing tests in  
 given the free choice above represents very closely the median  
 both of which instruction at Gary.

Handwritten sample for analysis

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TABLE II  
GENERALIZED<sup>1</sup> CITY WIDE<sup>1</sup> MEDIAN SCORES FOR RATE<sup>2</sup> AND QUALITY OF HANDWRITING

| GRADE | COMPOSITION       |                  | FREE CHOICE |                  | DICTATION |                  | REPRODUCTION      |                  |
|-------|-------------------|------------------|-------------|------------------|-----------|------------------|-------------------|------------------|
|       | RATE <sup>3</sup> | QUALITY<br>AYRES | RATE        | QUALITY<br>AYRES | RATE      | QUALITY<br>AYRES | RATE <sup>3</sup> | QUALITY<br>AYRES |
| 2     |                   |                  |             |                  | 25        | 26               |                   |                  |
| 3     |                   |                  | 20          | 31               | 32        | 29               | 30                |                  |
| 4     |                   |                  | 46          | 32               | 44        | 32               | 40                |                  |
| 5     | 27                | 32               | 60          | 34               | 57        | 35               | 50                |                  |
| 6     | 34                | 34               | 72          | 37               | 68        | 37               | 60                |                  |
| 7     | 41                | 37               | 82          | 41               | 80        | 38               | 70                |                  |
| 8     | 48                | 39               | 92          | 44               | 93        | 39               | 78                |                  |
| 9     | 54                | 42               | 102         | 45               | 101       | 40               | 83                | 41               |
| 10    | 59                | 46               | 108         | 46               | 107       | 41               | 86                |                  |
| 11    | 61                | 50               | 115         | 47               | 109       | 42               | 89                |                  |
| 12    | 64                | 51               | 121         | 48               | 110       | 43               | 92                |                  |
| 12    | 64                | 51               |             |                  |           |                  |                   |                  |

<sup>1</sup>For explanation of the sense in which these terms are used, see XI of Appendix A, page 473.

<sup>2</sup>Rate in letters per minute.

<sup>3</sup>Converted to letters per minute from words per minute, see page 57, and Table IX.

This table is to be read as follows: In the composition test the fourth grade ability is taken as ability to write at a median rate of 27 letters per minute with a quality of 32 (Ayres); in the free choice test at a rate of 46 letters per minute and quality 34; in the dictation test at a rate of 44 letters per minute and a quality of 32; in the reproduction test at a rate of 40 letters per minute, but the quality of writing was not measured except for the one grade given.

The average difference of actual from generalized score is in rate 1.5 letters per minute, and in quality 2.1 on the Ayres Scale.

TABLE III  
BASES OF FREEMAN'S STANDARDS IN HANDWRITING<sup>1</sup>

| KIND OF FIRM   | KIND OF WORK                    | NUMBER<br>EM-<br>PLOYED | IMPORTANCE<br>OF WRITING* |   |   |   | QUALITY OF WRITING†<br>REGARDED AS ESSENTIAL |                 |                  | IS SPEED<br>IMPORTANT? |
|----------------|---------------------------------|-------------------------|---------------------------|---|---|---|----------------------------------------------|-----------------|------------------|------------------------|
|                |                                 |                         | 1                         | 2 | 3 | 4 | VERTICAL                                     | MEDIUM<br>SLANT | EXTREME<br>SLANT |                        |
| Correspondence |                                 |                         |                           |   |   |   |                                              |                 |                  |                        |
| School.....    | Clerical.....                   | 15                      |                           | * |   |   | —                                            | 90              | —                | Yes                    |
| Department     | Clerical and                    | 19                      |                           |   |   |   | 70                                           | 70              | 60               | Yes                    |
| Store.....     | Accounting..                    |                         |                           |   |   |   |                                              |                 |                  |                        |
| Mail Order     | Stenography                     | 500                     |                           | * |   |   | 60                                           | 60              | 60               | Yes                    |
| House.....     | and Book-<br>keeping.....       |                         |                           |   |   |   | —                                            | 90 or better    |                  | Yes                    |
| Correspondence | Entry and book-<br>keeping..... | 30                      | *                         |   |   |   | 60                                           | 60              | 50               | Moderately             |
| School.....    | File Clerk. ....                | 400                     |                           | * |   |   | 60                                           | 60              | 70               | Yes                    |
| Mail-Order     |                                 |                         |                           |   | * |   |                                              |                 |                  |                        |
| House.....     |                                 |                         |                           |   |   |   |                                              |                 |                  |                        |
| Department     |                                 |                         |                           |   |   |   |                                              |                 |                  |                        |
| Store Whole-   |                                 |                         |                           |   |   |   |                                              |                 |                  |                        |
| sale.....      | General.....                    |                         |                           |   | * |   | 60                                           | 60              | 70               | Yes                    |
| Packing Com-   |                                 |                         |                           |   |   |   |                                              |                 |                  |                        |
| pany Rail-     |                                 |                         |                           |   | * |   | 60                                           | —               | —                | Yes                    |
| road Dept...   | Clerical.....                   | 90                      |                           |   |   |   | 70                                           | 60              | 60               | Yes                    |
| Department     |                                 |                         |                           |   |   |   |                                              |                 |                  |                        |
| Store.....     | General Office.                 | 82                      | *                         |   |   |   | —                                            | 80              | 70               | Yes                    |
| Mail-Order     |                                 |                         |                           |   |   |   |                                              |                 |                  |                        |
| House....      | Addressing....                  | 200                     | *                         |   |   |   | —                                            | 80              | 70               | Yes                    |

|                  |                    |     |   |   |    |    |    |            |
|------------------|--------------------|-----|---|---|----|----|----|------------|
| Correspondence   | Addressing . . . . | 76  | * |   | 70 | —  | —  | Yes        |
| School . . . . . |                    |     |   |   |    |    |    |            |
| Department       |                    |     |   |   |    |    |    |            |
| Store Claim      |                    |     |   |   |    |    |    |            |
| Dept. . . . .    | Clerical . . . . . | 50  |   | * | 30 | 40 | 40 | No         |
| Packing House    | Distribution . . . | 38  |   | * | —  | —  | 70 | Yes        |
| Mail-Order       |                    |     |   |   |    |    |    |            |
| House . . . . .  | Stock Clerk. . . . | 100 |   | * | 60 | 60 | 60 | Moderately |
| Packing House    | Account Sales . .  | 53  |   |   | —  | —  | 60 | Yes        |

\*No. 1 represents the highest degree and No. 4 the lowest degree of importance.

†In terms of the Ayres Scale.

‡Fourteenth Yearbook of the National Society for the Study of Education, p. 72.



choice test, but the improvement in quality from grade to grade is small in all tests.

The results of the three tests are consistent and show only such differences as are to be expected. In the elementary grades the qualities agree very closely. The quality in the eighth grade dictation test is lower than in the other tests, but this is undoubtedly due to the fact that attention was being given to spelling what were, for the Gary children, difficult words (average accuracy of spelling 55 per cent.). The free choice results in most grades are a little better in quality, probably because under the conditions of the test the children had had a day's preparation in writing the test sentences. In grades ten, eleven, and twelve the quality of writing in the composition test is slightly higher than in the other tests, but the rate is very much lower; also the students in the last year of the high school are a very select group, owing to the eliminations in the previous grades. However, the maximum differences are not large and the best quality reached in any test by any grade is not high.

#### DESIRABLE GOALS IN HANDWRITING

The conclusion that the writing of the Gary children is poor may seem unwarranted to certain persons. They may take the position that the Gary children write well enough; that the quality of writing shown in sample "A" is satisfactory; that the conventional school over-emphasizes the subject. Table III taken from the Four-

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been always had r

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beard his found he astor  
same the do to involu

stranger's appearance  
square built familia  
awe inspired that  
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bright the and s

teenth Yearbook of the National Society for the Study of Education is a reply to this criticism. It represents the judgments of a number of business houses in regard to the quality of writing that is essential. The standard quality for the eighth grade product as set by Freeman as a result of the investigation is quality 70 on the Ayres Scale (Figure 7).

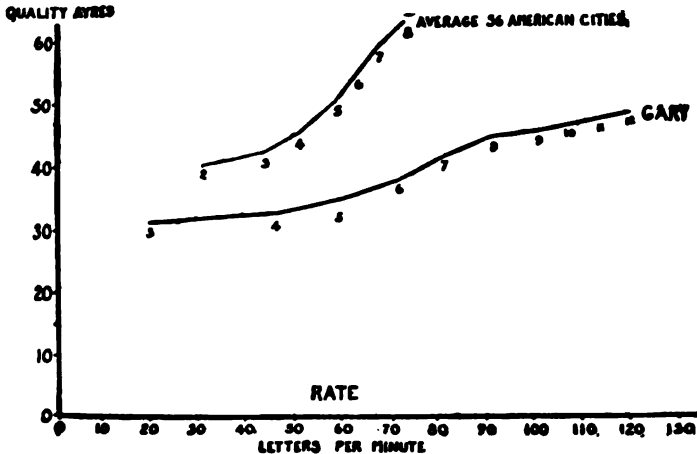
#### COMPARATIVE DATA<sup>1</sup>

In Gary results as a whole are rather higher in rate and much lower in quality than the results reported by other surveys (Table IV, Figures 8 and 9). For instance, the Gary eighth grade score for quality, 43 Ayres, is 12 points lower than Cleveland (55), 14 points lower than Starch's Standard (57), 20 points lower than Freeman's results (63), and 29 points lower than St. Louis (72). The differences in the third grade are often

<sup>1</sup>In survey work the temptation is great to compare results from city to city as if they were secured under identical conditions, but the methods of measurement are so new, and the factors to be controlled so many, that in spite of the recognized ability of the men engaged in survey work, variations in conditions are bound to occur. As shown in a later chapter, the effect of lack of knowledge of conditions is so serious that those making comparisons should be conscious of the danger of erroneous inferences. Nevertheless, whenever possible, in this report the Gary results are submitted with tables of similar results from other cities, and every effort has been made to array the data in such form that persons wishing to make comparisons may do so with the least danger of misrepresentation.

Those who make comparisons should always remember that while tests reveal differences in achievement, they do not in any way reveal the causes of the differences.

FIGURE 8  
COMPARATIVE GARY SCORES IN THE FREE CHOICE TEST  
HANDWRITING



The scale along the base of the figure shows rate or number of letters written per minute. The scale along the vertical axis represents quality on the Ayres Scale. The heavy solid line represents Gary scores in the free choice test. The light line represents average scores of fifty-six American cities. For both curves the positions of the grade medians are indicated by figures.

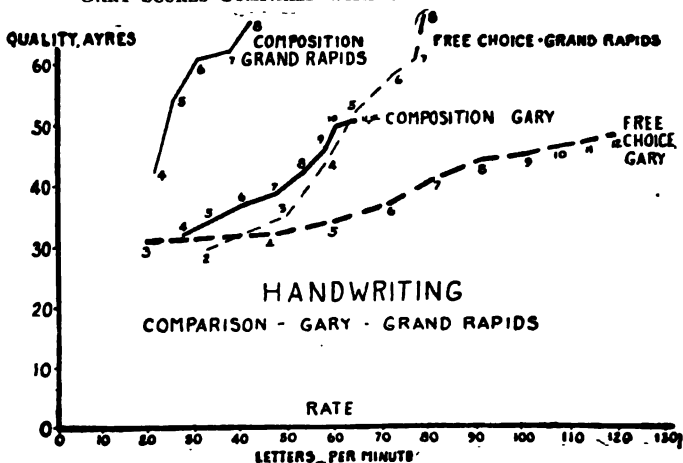
The graph, as a whole, shows that the Gary scores are much higher in rate and much lower in quality than the average of fifty-six American cities (Freeman).

small (Gary 30.8, St. Louis 31.3), but the rate of progress at Gary is apparently much less than in other cities. This is offset in part by the higher rate of writing at Gary. The data tend to show, therefore, that the Gary children wrote freely, paying little attention to the

## THE GARY SCHOOLS

FIGURE 9

GARY SCORES COMPARED WITH GRAND RAPIDS SCORES



The scale along the base of the figure represents rate, or number of letters written per minute. The scale along the vertical axis represents quality on the Ayres Scale. The heavy solid line shows Gary results in the composition test; the heavy broken line indicates free choice test. The light solid line represents the Grand Rapids results in the composition test, light broken line in the free choice test. On all the curves positions of the various grade medians are indicated by figures.

Curves show that the fifth grade in the free choice test at Grand Rapids wrote at about the rate and with about the quality of the twelfth grade in the composition test at Gary. For both Gary and Grand Rapids there are only slight differences in quality in the free choice and composition tests. The Grand Rapids rate in the composition test is probably not comparable with the Gary rate, as at Grand Rapids the writing of the compositions was timed only in the most general way; while at Gary the time each composition was finished was noted. However, it is probable that the only effect of this difference would be to shift the position of the curve with reference to the rate axis, not to change its character. For a statement in regard to the conditions under which the Grand Rapids tests were made see Table IV.

# HANDWRITING

41

TABLE IV  
COMPARATIVE RESULTS—FREE CHOICE TEST

| GRADE | GARY            |       | FREEMAN <sup>1</sup> |       | STARCK <sup>2</sup> |       | IOWA <sup>3</sup> |       | CLEVELAND <sup>4</sup> |       | ST. LOUIS <sup>5</sup> |       | GR. RAPIDS <sup>6</sup> |       | KANSAS CITY <sup>7</sup> |       |
|-------|-----------------|-------|----------------------|-------|---------------------|-------|-------------------|-------|------------------------|-------|------------------------|-------|-------------------------|-------|--------------------------|-------|
|       | NO. OF CHILDREN |       | 34,000               |       | OVER 6,000          |       | 27,864            |       | 10,528                 |       |                        |       |                         |       | 21,289                   |       |
|       | SCORE           |       | SCORE                |       | SCORE               |       | SCORE             |       | SCORE                  |       | SCORE                  |       | SCORE                   |       | SCORE                    |       |
|       | Rate            | Qual. | Rate                 | Qual. | Rate                | Qual. | Rate              | Qual. | Rate                   | Qual. | Rate                   | Qual. | Rate                    | Qual. | Rate                     | Qual. |
| 1     |                 |       |                      |       |                     |       |                   |       |                        |       |                        |       |                         |       |                          |       |
| 2     | 5.9             | 30.8  | 20.6                 | 39.7  | 20.0                | 27.0  | 29.1              | 28.5  |                        |       | 29.9                   | 28.1  | 33.5                    | 29.4  |                          | 28.0  |
| 3     | 47.2            | 33.5  | 43.8                 | 42.0  | 31.0                | 38.0  | 39.2              | 35.7  |                        |       | 31.7                   | 31.3  | 50.1                    | 34.5  |                          | 30.0  |
| 4     | 62.5            | 32.9  | 51.2                 | 45.8  | 47.0                | 43.0  | 49.6              | 39.8  |                        |       | 36.8                   | 35.3  | 59.3                    | 44.4  |                          | 36.0  |
| 5     | 70.7            | 36.6  | 59.1                 | 50.5  | 57.0                | 43.0  | 61.9              | 44.5  |                        |       | 52.1                   | 49.1  | 64.9                    | 51.7  |                          | 42.0  |
| 6     | 83.9            | 42.2  | 62.8                 | 54.5  | 65.0                | 47.0  | 65.5              | 52.3  | 60.0                   | 45.0  | 57.3                   | 55.7  | 73.0                    | 58.2  |                          | 50.0  |
| 7     | 90.9            | 43.2  | 67.9                 | 58.9  | 75.0                | 53.0  | 72.6              | 57.0  | 70.0                   | 48.0  | 62.8                   | 62.7  | 77.9                    | 61.4  |                          | 54.0  |
| 8     | 101.3           | 45.4  | 73.0                 | 62.8  | 83.0                | 57.0  | 76.5              | 61.0  | 80.0                   | 55.0  | 74.2                   | 72.4  | 84.3                    | 68.4  |                          | 56.0  |
| 9     |                 |       |                      |       |                     |       |                   |       |                        |       |                        |       |                         |       |                          |       |
| 10    | 112.5           | 45.9  |                      |       |                     |       |                   |       |                        |       |                        |       |                         |       |                          |       |
| 11    | 111.6           | 47.6  |                      |       |                     |       |                   |       |                        |       |                        |       |                         |       |                          |       |
| 12    | 120.0           | 48.3  |                      |       |                     |       |                   |       |                        |       |                        |       |                         |       |                          |       |

<sup>1</sup> Test given by teachers; graded by a class in experimental education, University of Chicago.

<sup>2</sup> Information not given.

<sup>3</sup> Test given by superintendents; scored by one person, a graduate student in education.

<sup>4</sup> Test given by teacher; scored by one member of survey staff.

<sup>5</sup> Probably the same as in Grand Rapids.

<sup>6</sup> Test given in nine schools by one person and scored by one person. Tests in the other buildings made by principals, but scored by same judge.

<sup>7</sup> Test given by teachers; scored by 30 trained normal school students.

quality of their work. However, the rate of writing at Gary corresponds closely to the results that have been obtained in other cities where children were writing freely and did not know that quality of handwriting was to be considered.<sup>1</sup>

For the free choice test the papers were sorted by grades for quality and the average rate found for each quality, as was done in Cleveland. For instance, in the fifth grade at Gary, 128 papers of quality 20 averaged in rate 58 letters per minute, while 14 papers of quality 50 averaged 62 letters per minute, an increase of 4 letters per minute. But at Cleveland the papers of quality 20 averaged 73 letters per minute, while the papers of quality 50 averaged 57 letters per minute, a decrease of 16 letters per minute (Table V, page 43, Figure 10, page 44). In other words, in Cleveland the poor writers wrote rapidly and the good writers slowly, but at Gary, except for the very, very poor writers who wrote very slowly, the good and poor writers wrote at about the same rate. The difference is probably due to the difference in the effect of the training in the two cities.<sup>2</sup>

#### SCHOOL TO SCHOOL COMPARISONS

In the dictation test, Froebel has 7 classes markedly above the city average and 4 markedly below. For the composition and free choice tests the figures are 1

<sup>1</sup>Fourteenth Yearbook, National Society for the Study of Education, Part I, pages 56 and 70.

<sup>2</sup>See also pages 252-253, Survey of St. Louis Public Schools. The St. Louis curves resemble Gary's, not Cleveland's, but at a lower rate level.

above, 6 below, and 2 above, 7 below respectively. For the Emerson school the figures are 2 above, 5 below; 2 above, 1 below; 2 above, 2 below (Table VI, page 45). The other schools show similar variations. The conclusion to be drawn is that there is almost no trace of constant differences from school to school. The differences in the organization and administration of the four schools and

TABLE V

RATE—QUALITY DEVELOPMENT IN GARY AND IN CLEVELAND

| QUALITIES       | NO. OF CASES | AVERAGE RATE FOR VARIOUS QUALITIES |           |              |              |           |
|-----------------|--------------|------------------------------------|-----------|--------------|--------------|-----------|
|                 |              | FIFTH GRADE                        |           | NO. OF CASES | EIGHTH GRADE |           |
|                 |              | GARY                               | CLEVELAND |              | GARY         | CLEVELAND |
| 10 <sup>1</sup> | 9            | 62                                 |           |              |              |           |
| 20              | 128          | 58                                 | 73        | 10           | 78           | 97        |
| 30              | 128          | 64                                 | 66        | 39           | 94           | 88        |
| 40              | 61           | 66                                 | 63        | 53           | 93           | 85        |
| 50              | 14           | 62*                                | 57        | 23           | 92           | 81        |
| 60              | 6            | 63                                 | 57        | 7            | 93           | 78        |
| 70              | 1            | 45                                 | 57        |              |              | 78        |
| 80              |              |                                    | 54        |              |              | 75        |
| 90              |              |                                    | 51        |              |              | 71        |

<sup>1</sup>In this report, the range of scores in each interval of a distribution is from the value given in the table up to but not including the next higher value. For instance, 20 in this table indicates a range of scores from quality 20.0 to and including quality 29.99+, but not quality 30.0.

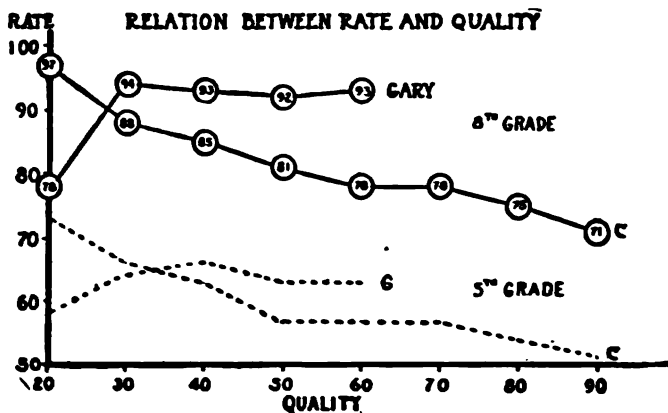
\*Average 65 if one extremely low score is ignored.

The table is to be read as follows: Of nine individual records at Gary, whose quality of writing ranged from 10 to 19 on Ayres' Scale, the average rate of writing was 62 letters per minute. Of 128 cases in Gary of quality 20 to 29 the average rate of writing was 58 letters per minute, while at Cleveland the rate for samples of the same quality was 73 letters per minute. The number of cases in Cleveland is not known. Other results in the table are to be read in similar fashion.



## THE GARY SCHOOLS

FIGURE 10  
RATES OF WRITING IN GARY AND IN CLEVELAND<sup>1</sup>



The horizontal axis represents quality. The vertical axis represents rate. Position of circles represent both rate and quality. The number of letters written per minute for each quality is given in the circles. Solid line represents eighth grade, dotted line represents fifth grade. Lines marked "G" represent Gary scores, and those marked "C" represent Cleveland scores.

Inferences: In Cleveland there is an inverse relation between rate and quality. The writing of the children who had the highest rate was the poorest, while those who wrote most slowly had the highest quality. At Gary, except for very low qualities, the rate of writing was the same for all qualities. The children who wrote most slowly at Gary had also the poorest writing.

in the social conditions of their pupils are not reflected in any positive fashion in the results of the writing tests.

<sup>1</sup>See Table V, page 43.

TABLE VI  
CLASS DEVIATIONS<sup>1</sup> FROM GENERALIZED CITY SCORE  
Based upon quality of writing.

| TEST            | DICTATION      |       | COMPOSITION |                | FREE CHOICE |       |
|-----------------|----------------|-------|-------------|----------------|-------------|-------|
|                 | NO. OF CLASSES | ABOVE | BELOW       | NO. OF CLASSES | ABOVE       | BELOW |
| SCHOOL          |                |       |             |                |             |       |
| Froebel. ....   | 31             | 7     | 4           | 22             | 1           | 6     |
| Emerson. ....   | 17             | 2     | 5           | 11             | 2           | 1     |
| Jefferson. .... | 18             | 3     | 5           | 13             | 2           | 0     |
| Beveridge. .... | 18             | 3     | 4           | 12             | 4           | 4     |

<sup>1</sup>Classes which deviate from the generalized city score by more than one tenth of this median. For the detailed tables see III of Appendix A. Similar tables were prepared for all school to school comparisons.

The table is to be read as follows: In the Froebel school of 31 classes tested in the dictation test, 7 were markedly above the city wide median and 4 were below. Of 22 classes in the composition test, 1 was above the median and 6 below. Of 23 classes in the free choice test, 2 were above the median and 7 below.

A difference was called marked when it exceeded one tenth of the city wide grade score.

## CONCLUSION

The results reported above indicate consistently that handwriting instruction at Gary is producing very small effect upon the product. The improvement in quality is small and does not keep pace with the change in the rate of writing.

## §2. CRITICAL DISCUSSION

## CHARACTERISTICS OF HANDWRITING

Development of skill in handwriting is essentially the development of a motor habit. However, good writing is dependent not alone on the perfection of motor habits, but on the harmony between the visual, movement, pressure, and thought "controls" which keep the writing process going and direct it.

In spite of the complexity of writing ability, performance in a writing test furnishes a simple record which is definitely objective and easily measurable. This measurement may follow either of two lines, measurement of gross characteristics only, or measurement of analytical details. The gross characteristics are rate (number of letters written per unit of time) and quality (or goodness, general merit, etc.). For survey purposes measurement of gross characteristics alone is of importance, and only such was made in this case.

As the function of writing is to record thought in such a form that it can be easily understood by others, legibility is sometimes given as a quality to be measured.

Legibility, however, is itself complex, being dependent upon the relative excellence of form, alignment, and other characteristics. In comparing two samples it is quite impossible to decide on the basis of subjective judgment alone whether or not one sample is more legible than the other. A real measure of legibility requires accurate measurement of the time taken to read a sample under carefully controlled conditions. On the other hand, any and every sample produces on a reader an impression of goodness or badness into which the many particular impressions blend. Accordingly, the expression "quality" or "general merit" will be used in place of legibility. That is, it is believed that whether measurement is made by the Thorndike or by the Ayres Scale, comparison proceeds on the basis of the impression produced by the samples as wholes, and not upon basis of legibility alone.

#### TESTING CONDITIONS

Two direct problems are involved in measurement of handwriting: (1) control of the conditions under which the samples are secured, and (2) measurement of the rate and quality of the resultant writing.

Writing, as a motor habit, is under voluntary control. That is, an individual may, within limits, vary the rate and quality of his writing at will. In general, the more a person has to hurry, the less care he will be able to give to the formation of his letters, and vice versa. Hence, the performance of an individual will vary as the con-

ditions under which he writes vary. It becomes important, therefore, to choose such conditions that the samples secured may be of such a character that inferences as to the abilities of the children will be reliable.

The physical factors influencing writing may be dismissed at once. At Gary all tests were conducted in regular classrooms, and the writing was with pen and ink (pencil was used in the lowest grades and in a few other cases where ink was not available) on paper of good quality, so that temperature, humidity, ventilation, materials, etc., were those which usually prevail in school work. The main factors to be controlled were, therefore, two—incentive and subject matter.

#### METHODS OF SECURING SAMPLES

Teachers of writing often base their judgments as to children's ability upon samples secured by asking the children for their best writing. This emphasis on quality, as everyone well knows from his own experience, leads to a highly specialized performance quite unlike the usual writing of the individual. The purpose of this survey, however, was conceived as an effort to determine real ability,<sup>1</sup> not maximum perform-

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<sup>1</sup>The reader should remember that the real ability of an individual is his median performance or effective ability. That test is to be judged the most perfect test of handwriting which reveals not the best writing of which the individual is capable, nor the worst which he will do, but the quality nearest like that shown by his penmanship under everyday conditions in which the writing activity is functioning normally. The author considers it of utmost importance for a correct understanding of

ance. Therefore, quality was not emphasized in securing samples.

A method in more general use is that of giving the children material to copy or write, and wording the instructions in such a way that the children understand they are free to determine for themselves the rate and quality of their writing. A test of this character is known as a free choice test. The instructions recommended by Starch are "write as well as you can and as rapidly as you can." In the Cleveland Survey, the teachers were told that papers would be marked for both speed and quality. The free choice test has been widely used. The instructions at Gary were made to conform to the Cleveland model.<sup>1</sup>

The objection to the free choice test is that the element of choice prevents a real measure of the efficiency of the teaching. For if, as Freeman has shown,<sup>2</sup> certain levels of quality and certain rates of work are required for

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the results secured from the tests of handwriting in this survey that the distinction between performance and ability be clear. The point of this footnote is that the ability of an individual in handwriting is not to be inferred from a carefully prepared letter of application for a position in which the quality of writing is known to be a factor determining employment, nor from hastily scribbled notes written while riding on a train, but from the kind of writing most often appearing in the daily work. Test conditions should be such that the samples secured show writing of this type. See also Chap. VIII.

<sup>1</sup>See Judd, C. H., *Measuring the Work of Public Schools*, Cleveland Survey.

<sup>2</sup>See *Fourteenth Yearbook of the National Society for the Study of Education*, page 72.

business life, the efficiency of school training should be judged by the percentage of the total product which measures up to the standard. In a free choice test a child capable of writing at the required rate and quality may choose to write at a much higher rate and with consequent sacrifice of quality, or may emphasize quality at the expense of rate. In other words, for measurement of efficiency the children should write at the standard rate (since rate of writing may be controlled through the rate at which material is dictated), and the resultant writing measured for quality. If, however, the material used is of unusual spelling difficulty, or is not easily comprehended, such difficulties may invalidate the test as a measure of writing ability. The material dictated at Gary served also as a test of ability to spell certain words. The value of the test as a writing test will be discussed later.

A fourth method of securing samples which represent children's ordinary<sup>1</sup> writing, and probably the best, is to use material written for another purpose. At Gary, the papers written in the composition test, where quality of writing was not emphasized were used also as samples of the children's writing. As a check upon these results,

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<sup>1</sup>It should be recognized, of course, that "ordinary" is here used to mean the kind of writing which the children have been in the custom of using for their written work in the composition class. It may or may not resemble the "ordinary" writing of the child out of school. In a class where the teacher of English composition has emphasized quality of writing the children might pay more attention to quality than in a class where the English teacher did not consider writing at all.

in certain classes reproductions of the simple story used as a test of comprehension in reading were also scored for handwriting.

The second factor which affects the quality of the writing is the material written. Obviously, if much attention must be given to the understanding or spelling of unfamiliar words, little can be given to the writing. Most free choice tests use as material a familiar stanza, as "Mary had a little lamb," which is written again and again. In Cleveland the material for all grades was the first three sentences of Lincoln's Gettysburg speech. The instructions to the teachers provided, however, that as a preliminary preparation the pupils should "read and copy this (material) until they were thoroughly familiar with it and practically knew it by heart." The same material<sup>1</sup> was used in the Gary test and the same plan of preliminary preparation by the teacher<sup>2</sup> was followed. In Cleveland, the tests were given by the teacher, and in Gary, by specially trained examiners. No attempt was made in either Gary or Cleveland to find out how completely the teachers had availed themselves of the opportunity to practice on the test material.

In the dictation exercises the words used to test spelling were taken from Ayres' thousand commonest words in written English. As far as possible, no test word was

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<sup>1</sup>See page 487.

<sup>2</sup>One day's preparation was provided for at Gary; at Cleveland the amount is not specified, but may have been as much as a week. See: *Measuring the Work of the Public Schools*, page 235.



used which was not of less spelling difficulty than the other words in the sentences. It was expected that the dictation sentences would be easy material, well within the powers of the children, but owing to the limited abilities of the Gary children in spelling, it is probable that the material was too difficult to afford a true measure of the children's writing ability. Therefore, the results from the dictation tests should have the least weight in making decisions as to the character of the product of writing instruction at Gary.

The rate of dictation was based upon a number of determinations by Freeman,<sup>1</sup> Curtis<sup>1</sup> and others, of the rate at which children write when writing freely (as in reproducing a story). In other words, the material was dictated at the rate at which children ordinarily write, in order to secure samples whose quality might correspond to the quality of their ordinary writing. This method prevents over emphasis on quality. It forces some children to write at what is for them an abnormally high rate. The purpose of the test is not to secure the best writing of which the children are capable, but to determine how many of the children have been developed to the required quality level at the given rate level.<sup>2</sup> As the results of the free choice test show, the rates at which the material was dictated were almost exactly the rates

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<sup>1</sup>Fourteenth Yearbook, Part I, National Society for the Study of Education, pages 56, 70, 76.

<sup>2</sup>The method of this test did not function at Gary because there was no tendency on the part of the children to over emphasize quality.

of writing chosen by the children in the free choice test.<sup>1</sup>

From the foregoing discussion it will be seen that conclusions as to writing abilities of the Gary children are based upon a series of measurements which give opportunity for significant variations in performance.

#### METHOD OF SCORING

The scores for rate of writing in the free choice test were determined as follows: Immediately upon the completion of a test the examiner had the children exchange papers. He then passed each child a score card.<sup>2</sup> In all grades the children filled out the blanks on the card and then in grades five to twelve, by the aid of the count of the letters of the test passages printed on the back of the card, they determined the number of letters that had been written in two minutes. Later this count was verified by the examiners, mistakes noted and counted, and the rate computed.

It was assumed that the letters written were of equal difficulty, although this was known not to be the case. The letter "i" is much easier to make than "g," for example. However, in writing one hundred words the relative frequency of the different letters is so constant (Table VII) that the errors due to differences in the difficulty of the various letters are negligible. The third and fourth grade scores may be in error by a small

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<sup>1</sup>In grades eleven and twelve the controlled rate was approximately ten letters per minute lower than in the free choice test.

<sup>2</sup>See Appendix B, page 488.



amount from this cause, but as the relative difficulty of the letters is unknown, it is not possible to apply a correction for this factor.

A far greater source of error in determining rate of writing is found in the difficulty presented to the children by certain words. For instance, the rate of writing of the third grade in the free choice test was but five<sup>1</sup> letters per minute. The fourth and other grade rates for these same tests are in substantial agreement (fourth grade 42-44). It is probable, therefore, that some factor was operating to depress the third grade scores in the free choice test.

Upon examining the test material from this point of view, one is struck by the difficulty of the first phrase: "Fourscore and seven years ago." This is probably the whole cause of the low score. The material was too difficult for third grade children. However, no trace of similar effects is observable in other grades.

In the dictation tests, no measurement of rate was necessary as the tests were constructed to be dictated at a given rate. The formula used in the construction of the tests was:

$$T = nr + \frac{n}{r}$$

in which  $T$  = the total time allowed,  $n$  = the number of letters to be written, and  $r$  = the rate in seconds per letter. The correction  $\frac{n}{r}$  is an allowance made for the time needed for dictation, the rate of reading being

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<sup>1</sup>See Table IV, page 41.

ten letters per second. The value of  $r$  for the various grades was as follows:

|        |        |      |      |      |     |     |     |
|--------|--------|------|------|------|-----|-----|-----|
| Grades | 2      | 3    | 4    | 5    | 6   | 7   | 8   |
| $r$    | = 2.40 | 1.87 | 1.86 | 1.05 | .88 | .75 | .64 |

In the composition and reproduction tests the children counted the number of words written and recorded their scores on their papers. These scores were later verified by the examiner and transferred to cards.

For the composition and reproduction tests the scores in words written per minute were converted to letters per minute by determining the average number of letters per word for a series of papers in each grade. After four or five papers the results are constant. In the sixth grade ten papers chosen at random were used (Table VIII, page 57). In other grades tabulations were carried to constant results only, not less than five papers being used in any grade.

The average values finally selected for converting word per minute into letters per minute will be found in Table IX, page 58.

#### MEASUREMENT OF QUALITY

The Ayres Handwriting Scale ("Three Slant" edition) was employed to determine quality. This scale consists of a series of specimens of handwriting ranging in quality from very bad to very good. The samples were chosen on a basis of "legibility"; that is, careful records were made of the time required to read a large number of different samples and certain of these were chosen

TABLE VIII  
CUMULATIVE COUNT OF NUMBER OF LETTERS PER WORD, TEN RANDOM PAPERS (SIXTH GRADE)

| PAPER<br>NUMBER | NUMBER OF LETTERS PER WORD |     |     |     |     |     |    |    |   |    | TOTAL<br>WORDS | AVERAGE<br>LETTERS<br>PER WORD |
|-----------------|----------------------------|-----|-----|-----|-----|-----|----|----|---|----|----------------|--------------------------------|
|                 | 1                          | 2   | 3   | 4   | 5   | 6   | 7  | 8  | 9 | 10 |                |                                |
| 1               | 10                         | 28  | 42  | 44  | 15  | 7   | 8  | 2  | 0 | 4  | 160            | 3.73                           |
| 2               | 18                         | 70  | 102 | 88  | 22  | 20  | 21 | 10 | 0 | 7  | 353            | 3.75                           |
| 3               | 28                         | 123 | 186 | 128 | 44  | 30  | 28 | 10 | 0 | 7  | 584            | 3.57                           |
| 4               | 46                         | 165 | 246 | 170 | 73  | 42  | 30 | 12 | 0 | 7  | 791            | 3.62                           |
| 5               | 48                         | 206 | 316 | 251 | 110 | 58  | 34 | 17 | 4 | 7  | 1,051          | 3.61                           |
| 6               | 66                         | 254 | 401 | 309 | 136 | 81  | 39 | 23 | 4 | 7  | 1,320          | 3.59                           |
| 7               | 77                         | 293 | 453 | 356 | 166 | 91  | 44 | 23 | 4 | 7  | 1,504          | 3.57                           |
| 8               | 85                         | 353 | 542 | 424 | 188 | 125 | 57 | 28 | 4 | 7  | 1,813          | 3.60                           |
| 9               | 106                        | 389 | 595 | 471 | 205 | 140 | 63 | 33 | 4 | 8  | 2,014          | 3.60                           |
| 10              | 109                        | 414 | 631 | 503 | 224 | 162 | 69 | 34 | 4 | 9  | 2,149          | 3.61                           |

This table is to be read as follows: The total length of paper No. 1 was 160 words; of these 10 were words of one letter, 28 of two letters, 42 words of three letters, and so on, the average length being 3.73 letters per word. Papers Nos. 1 and 2 together contain 358 words, of which 18 were words of one letter, 70 were words of two letters, and so on. The reader should note that the results in the last column are practically constant after the fourth paper.

as units in a scale. The differences in legibility from sample to sample were made equal.<sup>1</sup>

In using the scale, a sample of writing is compared with the sample of the scale until one is found which corresponds in general quality with the sample being measured. The number of the scale sample is then noted and the specimen being measured is given the same value. If the sample being measured falls between two scale samples, it is given a value to correspond.

#### RELIABILITY OF RESULTS

In order to make the reported handwriting results as reliable as possible, the eighth grade papers in all

TABLE IX

AVERAGE VALUES FOR CHANGING RATE OF WRITING FROM WORDS PER MINUTE TO LETTERS PER MINUTE

| GRADE | COMPOSITION | REPRODUCTION |         |          |
|-------|-------------|--------------|---------|----------|
|       |             | TEST I       | TEST II | TEST III |
| 4     | 3.4         | 3.4          |         |          |
| 5     | 3.5         | 3.4          | 4.0     |          |
| 6     | 3.6         | 3.4          | 4.0     |          |
| 7     | 3.7         |              | 4.0     |          |
| 8     | 3.9         |              | 4.0     | 3.4      |
| 9     | 3.9         |              |         | 3.6      |
| 10    | 3.9         |              |         | 3.5      |
| 11    | 4.0         |              |         | 3.5      |
| 12    | 4.0         |              |         | 3.8      |

This table is to be read as follows: The rate of writing in the composition test in the fourth grade was changed to letters per minute by multiplying the number of words written per minute by 3.4. The resulting values are the true rates within approximately 1 per cent.

<sup>1</sup>See Bulletin No. 113, Division of Education, Russell Sage Foundation.

the writing tests were scored by from three to five judges and the median scores taken as the real quality of the samples. The scores are given in full for one class (Table X, page 60 and Figure 11, page 62). Although individual judges differ widely on some samples, yet the scores as a whole show close agreement. Of the 170 individual ratings on the 34 papers of the class, 73, or 43 per cent., agree exactly with the median scores, 57 more, or 34 per cent., fall within five points, or half a step of the scale, and only six, or 3.5 per cent., of the judgments differ more than one step from the median value. The average deviation of the individual judgments from the medians is 4.3 points, slightly less than half a step on the scale. But 47 of the 97 deviations were positive and 50 negative, so that the median score of the class as determined by each of the judges alone is closely the same as the median class score determined from the median score on each sample. For two of the judges the differences are zero. Two judges differ by one point only, and the other by six points. If the actual median scores are used, all the differences, except one, are zero. The effect of combining the scores of the different judges is to eliminate the wide variations which occur with each judge on certain samples.

The constancy of the general results is quite remarkable. The average deviation of the judges in 1901 judgments of the papers of five eighth grade classes is 3.9 points. That is, a single judgment will, on the average, differ from the median of five independent judgments



TABLE X  
 SCORES OF AN EIGHTH GRADE CLASS BY FIVE JUDGES SCORING INDEPENDENTLY WITH AYRES HANDWRITING SCALE

| PAPER<br>NO. | QUALITY ACCORDING<br>TO JUDGE |    |    |    |    | MEDIAN<br>QUALITY | DEVIATION OF EACH JUDGE |     |     |     |     | TOTAL | AVERAGE |
|--------------|-------------------------------|----|----|----|----|-------------------|-------------------------|-----|-----|-----|-----|-------|---------|
|              |                               |    |    |    |    |                   |                         |     |     |     |     |       |         |
|              | A                             | B  | C  | D  | E  |                   | A                       | B   | C   | D   | E   |       |         |
| 1            | 20                            | 25 | 25 | 30 | 25 | 25                | -5                      | 0   | 0   | +5  | 0   | 10    | 2.0     |
| 2            | 35                            | 30 | 30 | 30 | 20 | 30                | +5                      | 0   | 0   | 0   | -10 | 15    | 3.0     |
| 3            | 35                            | 35 | 45 | 35 | 25 | 35                | 0                       | +10 | 0   | 0   | -10 | 20    | 4.0     |
| 4            | 45                            | 35 | 35 | 40 | 30 | 35                | +10                     | 0   | 0   | +5  | -5  | 20    | 4.0     |
| 5            | 30                            | 35 | 40 | 35 | 30 | 35                | -5                      | 0   | +5  | 0   | -10 | 15    | 3.0     |
| 6            | 30                            | 35 | 35 | 40 | 25 | 35                | -5                      | 0   | 0   | +5  | -10 | 20    | 4.0     |
| 7            | 35                            | 30 | 30 | 45 | 35 | 35                | 0                       | -5  | 0   | +10 | 0   | 20    | 4.0     |
| 8            | 30                            | 35 | 35 | 35 | 35 | 35                | -5                      | 0   | 0   | 0   | 0   | 5     | 1.0     |
| 9            | 35                            | 30 | 30 | 35 | 40 | 35                | 0                       | -5  | -5  | 0   | +5  | 15    | 3.0     |
| 10           | 35                            | 30 | 25 | 45 | 35 | 35                | 0                       | -5  | -10 | +10 | 0   | 25    | 5.0     |
| 11           | 40                            | 30 | 40 | 50 | 35 | 40                | 0                       | 0   | 0   | +10 | -5  | 25    | 5.0     |
| 12           | 45                            | 40 | 40 | 40 | 40 | 40                | +5                      | 0   | 0   | +10 | 0   | 15    | 3.0     |
| 13           | 50                            | 40 | 30 | 50 | 30 | 40                | +10                     | 0   | -10 | +10 | -10 | 40    | 8.0     |
| 14           | 45                            | 40 | 35 | 40 | 40 | 40                | +5                      | 0   | -5  | 0   | 0   | 10    | 2.0     |
| 15           | 35                            | 40 | 25 | 40 | 45 | 40                | -5                      | 0   | -15 | 0   | +5  | 25    | 5.0     |
| 16           | 40                            | 45 | 30 | 45 | 35 | 40                | 0                       | +5  | -10 | +5  | -5  | 25    | 5.0     |
| 17           | 40                            | 45 | 40 | 70 | 40 | 40                | 0                       | +5  | 0   | +30 | 0   | 35    | 7.0     |
| 18           | 40                            | 45 | 30 | 40 | 50 | 40                | 0                       | +5  | -10 | 0   | +10 | 25    | 5.0     |
| 19           | 45                            | 40 | 35 | 40 | 40 | 40                | +5                      | 0   | -5  | 0   | 0   | 10    | 2.0     |
| 20           | 35                            | 40 | 45 | 50 | 35 | 40                | -5                      | 0   | +5  | +10 | -5  | 25    | 5.0     |
| 21           | 40                            | 40 | 40 | 50 | 30 | 40                | 0                       | 0   | 0   | +10 | -10 | 20    | 4.0     |

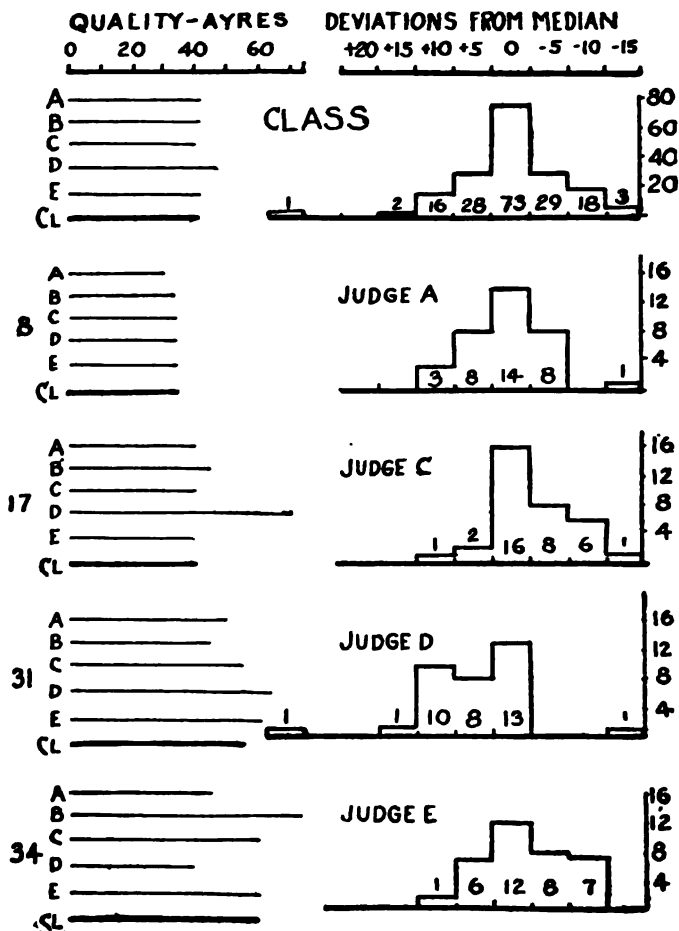
|    |    |    |    |    |    |     |     |     |     |     |    |      |
|----|----|----|----|----|----|-----|-----|-----|-----|-----|----|------|
| 22 | 40 | 35 | 40 | 45 | 40 | 0   | 0   | -5  | 0   | +5  | 10 | 2.0  |
| 23 | 40 | 40 | 45 | 45 | 40 | 0   | 0   | 0   | +5  | +5  | 10 | 2.0  |
| 24 | 42 | 35 | 40 | 45 | 35 | +2  | -5  | 0   | +5  | -5  | 17 | 3.4  |
| 25 | 40 | 30 | 30 | 50 | 45 | 0   | -10 | -10 | +10 | +5  | 35 | 7.0  |
| 26 | 40 | 35 | 45 | 50 | 45 | -5  | -10 | 0   | +5  | 0   | 20 | 4.0  |
| 27 | 50 | 55 | 40 | 45 | 45 | +5  | +10 | -5  | 0   | 0   | 20 | 4.0  |
| 28 | 55 | 50 | 45 | 50 | 45 | +5  | 0   | -5  | 0   | -5  | 15 | 3.0  |
| 29 | 60 | 50 | 40 | 50 | 45 | +10 | 0   | -10 | 0   | -5  | 25 | 5.0  |
| 30 | 50 | 55 | 50 | 60 | 40 | 0   | +5  | 0   | +10 | -10 | 25 | 5.0  |
| 31 | 50 | 45 | 55 | 65 | 60 | -5  | -10 | 0   | +10 | +5  | 30 | 6.0  |
| 32 | 55 | 45 | 50 | 60 | 55 | +5  | -10 | -5  | +5  | 0   | 20 | 4.0  |
| 33 | 60 | 50 | 55 | 70 | 45 | +5  | -5  | 0   | +15 | -10 | 35 | 7.0  |
| 34 | 45 | 75 | 60 | 40 | 60 | -15 | +15 | 0   | -20 | 0   | 50 | 10.0 |

MEDIAN SCORE FOR CLASS

| COMPUTED | 43 | 42 | 41 | 48 | 42 | 122 | 120 | 135 | 205 | 150 | 732 | TOTAL   |
|----------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|---------|
| ACTUAL   | 40 | 40 | 40 | 45 | 40 | 3.6 | 3.5 | 4.0 | 6.0 | 4.4 | 4.3 | AVERAGE |

This table is to be read as follows: Paper No. 1 was judged to be of quality 20 by Judge A, 25 by B, 25 by C, 30 by D, and 25 by E. The median of the five judgments was 25. The judgment of A was, therefore, 5 points below the median, of D, 5 points above the median. The total deviation of the five judgments from the median was 10 points, or an average of 2 points. The computed medians are based on the distributions. The actual medians are the median scores. One hundred twenty two is the sum of the deviations made by Judge A on the entire 34 papers. His average deviation per sample was 3.6 points.

**FIGURE 11**  
**VARIATIONS IN QUALITY SCORES ASSIGNED BY MEANS OF AYRES**  
**SCALE<sup>1</sup>**  
**HANDWRITING-VARIATIONS IN SCORING**



<sup>1</sup>See Table X, page 60.

FIGURE 11—*Continued*

Diagrams at the left hand side of the figure represent individual papers. The numbers 8, 17, 31, 34, etc., refer to the numbers of the papers in Table X. Letters A, B, C, D, and E refer to the different judges. CL indicates values for class as a whole. Each light line in the diagrams represents the value assigned the sample by one judge. Each heavy line represents the value adopted as the true value of the sample.

The scale along the top of the figure represents quality on the Ayres Scale. The diagrams show that for the class as a whole the class score as determined from the scores of each single judge, except D, agrees closely with the value as determined from the combined scores of the five independent judges.

Diagram marked 8 represents the score of a sample upon which there was close agreement between the five judges. Paper 17 represents the scores for a sample in which Judge D showed a wide variation. Papers 31 and 34 represent samples on which there was a little agreement between the different judges.

The diagrams on the right hand side of the figure show the distributions of the deviations from the scores adopted as the true value of the samples. The scale at the top shows the magnitude and quality of the deviations. The scale at the right of each distribution shows the number of deviations of a given type, as do also the figures written in the diagrams just above the base line. Diagram for Judge A is to be read as follows:

Out of the 34 papers, Judge A gave 3 scores which were 10 points higher than the proper value of the paper, 8 scores which were 5 points higher, 14 scores which agreed exactly with the true value, 8 scores which were 5 points lower than the true value, and 1 which was 15 points lower.

Note that Judges C and E have a tendency to score papers too low while Judge A has a tendency to score papers too high. Note also that in the distributions of the deviations for the class as a whole the distribution is symmetrical about the zero point, that 130 out of 170 deviations are not greater than 5 points.

## THE GARY SCHOOLS

TABLE XI  
VALUE OF STANDARD SAMPLES ON AVERA SCALE

| SAMPLE NO. | SOURCE | THORN-<br>DIKE<br>VALUE | VALUE ON AVERA<br>SCALE AS DETER-<br>MINED BY |                | SAMPLE<br>NO. | SOURCE | THORN-<br>DIKE<br>VALUE | VALUE ON AVERA<br>SCALE AS DETER-<br>MINED BY |                |
|------------|--------|-------------------------|-----------------------------------------------|----------------|---------------|--------|-------------------------|-----------------------------------------------|----------------|
|            |        |                         | AVERA<br>JULIAN                               | GARY<br>JULIAN |               |        |                         | AVERA<br>JULIAN                               | GARY<br>JULIAN |
| 4          | S      | 13.0                    | 70                                            | 77             | 84            | H      | 16.0                    | 80                                            | 74             |
| 5          | A      | 11.7                    | 60                                            | 57             | 80            | H      | 16.0                    | 80                                            | 83             |
| 6          | S      | 6.0                     | 20                                            | 20             | 90            | H      | 16.0                    | 80                                            | 77             |
| 7          | A      | 12.0                    | 70                                            | 60             | 106           | H      | 11.0                    | 60                                            | 60             |
| 8          | A      | 12.8                    | 70                                            | 65             | 110           | A      | 6.6                     | 50                                            | 20             |
| 9          | A      | 13.2                    | 70                                            | 60             | 121           | H      | 4.0                     | 10                                            | 16             |
| 11         | A      | 14.0                    | 70                                            | 75             | 125           | H      | 14.0                    | 80                                            | 97             |
| 12         | S      | 6.0                     | 20                                            | 25             | 134           | A      | 16.2                    | 80                                            | 80             |
| 14         | S      | 8.0                     | 30                                            | 33             | 141           | H      | 17.0                    | 80                                            | 85             |
| 17         | S      | 10.0                    | 50                                            | 50             | 201           | A      | 9.2                     | 40                                            | 48             |
| 19         | S      | 14.0                    | 60                                            | 65             | 202           | A      | 13.5                    | 40                                            | 40             |
| 21         | S      | 9.0                     | 40                                            | 35             | 203           | A      | 13.7                    | 70                                            | 83             |
| 22         | S      | 8.8                     | 30                                            | 32             | 208           | A      | 13.7                    | 80                                            | 87             |
| 23         | S      | 11.0                    | 60                                            | 65             | 207           | A      | 9.8                     | 60                                            | 48             |
| 24         | S      | 13.0                    | 70                                            | 75             | 208           | A      | 8.5                     | 40                                            | 35             |
| 25         | A      | 12.7                    | 70                                            | 68             | 209           | A      | 6.8                     | 30                                            | 27             |
| 26         | S      | 13.0                    | 70                                            | 85             | 211           | A      | 7.2                     | 20                                            | 25             |
| 27         | A      | 15.5                    | 90                                            | 77             | 212           | A      | 10.5                    | 50                                            | 53             |
| 28         | S      | 8.0                     | 50                                            | 37             | 213           | A      | 12.6                    | 60                                            | 63             |
| 29         | A      | 15.4                    | 80                                            | 77             | 214           | A      | 11.5                    | 60                                            | 60             |

# HANDWRITING

65

|    |   |      |    |    |     |   |      |    |    |
|----|---|------|----|----|-----|---|------|----|----|
| 30 | S | 12.0 | 60 | 57 | 215 | A | 15.5 | 90 | 85 |
| 31 | S | 9.0  | 40 | 50 | 216 | A | 15.7 | 80 | 77 |
| 32 | S | 16.0 | 80 | 85 | 221 | A | 10.2 | 50 | 60 |
| 33 | A | 15.8 | 90 | 90 | 222 | A | 8.8  | 30 | 85 |
| 34 | A | 9.2  | 40 | 37 | 223 | A | 9.5  | 40 | 45 |
| 36 | A | 11.5 | 50 | 53 | 225 | A | 6.8  | 20 | 27 |
| 37 | A | 16.4 | 90 | 77 | 226 | A | 7.8  | 30 | 33 |
| 39 | A | 16.3 | 80 | 70 | 227 | A | 8.5  | 40 | 35 |
| 41 | A | 10.6 | 50 | 45 | 229 | A | 6.8  | 20 | 20 |
| 45 | S | 11.0 | 50 | 50 | 230 | A | 13.5 | 80 | 75 |
| 46 | A | 12.4 | 60 | 55 | 234 | A | 17.5 | 90 | 97 |
| 47 | S | 15.0 | 80 | 82 | 242 | A | 12.5 | 70 | 75 |
| 48 | S | 8.0  | 30 | 40 | 244 | A | 14.8 | 90 | 93 |
| 49 | S | 16.0 | 90 | 90 | 245 | A | 8.8  | 40 | 50 |
| 50 | A | 12.2 | 60 | 57 | 247 | A | 13.8 | 70 | 77 |
| 52 | S | 12.0 | 60 | 67 | 249 | A | 12.3 | 60 | 65 |
| 53 | A | 13.5 | 70 | 75 | 250 | A | 14.7 | 80 | 87 |
| 75 | S | 14.0 | 80 | 80 | 255 | A | 14.6 | 80 | 87 |
| 55 | S | 13.0 | 70 | 77 | 256 | A | 14.2 | 80 | 85 |
| 57 | A | 16.2 | 80 | 80 |     |   |      |    |    |

<sup>1</sup>Samples taken from the Thorndike Scale (S) and from Supplement A. Thorndike Values from Scale and from Teachers' College Record, Volume 15, No. 5, November, 1914. Page 11.

<sup>2</sup>The Gary judges estimated exact values as 35, 43, etc. The Ayres judges estimated the nearest scale value only, as 30, 50, etc.

The table is to be read as follows: Sample No. 4 derived from Thorndike's Scale has been assigned a value of 13.0 units by Thorndike on his scale. The value assigned the sample by judges in the office of the Division of Education of the Russell Sage Foundation was 70 Ayres, while the Gary judges estimated the value of the sample to be 77 Ayres.

less than half a unit of the scale. Of 1901 judgments, 931, or 49 per cent., agreed exactly with the median value for the sample. Of the remaining judgments, 497 were positive and 473 were negative. All the evidences show, therefore, that the judges used the scale in a consistent manner, and that a class score, even when determined by a single judge, would not be in error more than a small part of one division of the scale.

The quality of the writing of grades other than the eighth was determined by the scoring of one judge. In twenty two classes, however, mainly of the fourth and sixth grades, the papers were scored by two judges. The median difference in the median scores for the various classes as determined by the two judges independently is again a very small part of one step of the scale. These figures make it possible to say that the scores of the various classes may be depended upon to represent the quality of "writing" actually found in the papers within a third of one division of the scale.

#### STANDARDS OF JUDGMENT

To give the reported results real objective validity, the Gary judges scored a set of "standard samples." Part of these were taken from the Thorndike Scale, and the rest are the samples published by Thorndike for the purposes of teacher training, known as Supplement A.<sup>1</sup> The values assigned these samples by the Gary judges are

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<sup>1</sup>Teachers College Record, November, 1914.

# HANDWRITING

67

TABLE XII  
METHOD BY WHICH EQUIVALENT AYRES-THORNDIKE VALUES WERE DERIVED<sup>1</sup>

| AYRES TO THORNDIKE                                              |                                                      |                                                            |                                                    | THORNDIKE TO AYRES                                                               |                                                   |                                                  |                                          |
|-----------------------------------------------------------------|------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------|------------------------------------------|
| NO. OF ALL<br>SAMPLES<br>RATED 60<br>AYRES BY<br>GARY<br>JUDGES | VALUES AS-<br>SIGNED SAME<br>SAMPLES BY<br>THORNDIKE | NO. OF ALL<br>SAMPLES RATED<br>60 AYRES BY<br>AYRES JUDGES | VALUES<br>ASSIGNED SAME<br>SAMPLES BY<br>THORNDIKE | NO. OF ALL<br>SAMPLES<br>HAVING<br>THORNDIKE<br>VALUE OF<br>FROM 12.0<br>TO 12.9 | ACTUAL<br>THORNDIKE<br>VALUE OF<br>EACH<br>SAMPLE | AYRES<br>VALUES<br>ASSIGNED<br>BY GARY<br>JUDGES | AYRES<br>VALUES<br>ASSIGNED<br>BY JUDGES |
| 221                                                             | 10.2                                                 | —                                                          | —                                                  | 30                                                                               | 12.0                                              | 57                                               | 60                                       |
| —                                                               | —                                                    | 23                                                         | 11.0                                               | 7                                                                                | 12.0                                              | 60                                               | 70                                       |
| 106                                                             | 11.0                                                 | 106                                                        | 11.0                                               | 52                                                                               | 12.0                                              | 67                                               | 60                                       |
| 6                                                               | 11.7                                                 | 6                                                          | 11.7                                               | 50                                                                               | 12.2                                              | 57                                               | 60                                       |
| 30                                                              | 12.0                                                 | 30                                                         | 12.0                                               | 249                                                                              | 12.3                                              | 65                                               | 60                                       |
| 7                                                               | 12.0                                                 | —                                                          | —                                                  | 46                                                                               | 12.4                                              | 55                                               | 60                                       |
| —                                                               | —                                                    | 52                                                         | 12.0                                               | 242                                                                              | 12.5                                              | 75                                               | 70                                       |
| 50                                                              | 12.2                                                 | 50                                                         | 12.2                                               | 213                                                                              | 12.6                                              | 63                                               | 60                                       |
| —                                                               | —                                                    | 249                                                        | 12.3                                               | 25                                                                               | 12.7                                              | 63                                               | 70                                       |
| —                                                               | —                                                    | 46                                                         | 12.4                                               | 8                                                                                | 12.8                                              | 65                                               | 70                                       |
| 213                                                             | 12.6                                                 | 213                                                        | 12.6                                               | —                                                                                | —                                                 | —                                                | —                                        |
| 25                                                              | 12.7                                                 | —                                                          | —                                                  | —                                                                                | —                                                 | —                                                | —                                        |
| 9                                                               | 13.2                                                 | —                                                          | —                                                  | —                                                                                | —                                                 | —                                                | —                                        |
| MEDIAN                                                          | 12.0                                                 | 19                                                         | 14.0                                               | AVERAGE                                                                          | 12.35                                             | 62.7                                             | 64                                       |

<sup>1</sup>From the data in this table the formula  $A (Ayres) \times 6.7 T (Thorndike)$ —so has been derived. That is, any Thorndike value multiplied by 6.7 gives a result from which, if 60 is subtracted, the remainder corresponds to the Ayres value.



TABLE XII—*Continued*

This table is to be read as follows: Sample 221 was one of those rated 60 by the Gary judges and was given a different rating by the Ayres judges. Sample 23 was rated 60 by the Ayres judges and was given a different rating by the Gary judge. Sample 106 was rated 60 by both sets of judges. The Thorndike value of sample 221 was 10.2, of sample 23 was 11.0, of sample 106 was 11.0, etc. The nine samples rated 60 Ayres by the Gary judges ranged in value according to Thorndike from 10.2 to 13.2. The median score was 12.0. Therefore, according to the Gary judges, 60 Ayres is, in general, equivalent to 12.0 Thorndike (A. D.  $\pm .7$ ). Similarly, according to the Ayres judges, 60 Ayres is, in general, equivalent to 12.1 Thorndike (A. D.  $\pm .6$ ).

In similar fashion, in the second part of the table, all samples having the same Thorndike value (12.35) are grouped together and the average Ayres value found. According to the Gary judges this value is  $62.5 \pm 4.4$ , according to the Ayres judges it is  $64 \pm 4.8$ . Each of the values in Table XI was determined in similar fashion.

given in Table XI, pages 64 and 65. Any person desiring to compare his standards with those of the groups of judges in this survey need but measure these standard samples on the Ayres Scale and compare his results with those given in the table.

The values of the standard samples on the Thorndike Scale were reported by Thorndike at the time the samples were published and are also given in Table XII, page 67. To check the Gary scoring, the samples were sent to Dr. Ayres with the request that they be scored by competent judges in the division of education of the Russell Sage Foundation, of which he is director. The median scores of five judgments on each sample as reported by him are also to be found in the table. These will be

considered as establishing the true Ayres value of the standard samples.

The individual judgments of each of the five Gary judges were checked against the Ayres standards. Individual variations were apparent, but the average score of the two judges who scored 90 per cent. of all the papers in this survey was found to agree almost exactly with the Ayres standards. These judges are C and D in Table X. The median score for each judge on each class for each case of multiple scoring was next determined, and in no case found to differ from the average score of these two judges more than six points higher or lower.<sup>1</sup> Further, the few classes not scored by them were compared, grade for grade, with the scores of the same classes in other tests which had been so scored. In only five cases was the variation more than five points, or half a step,<sup>2</sup> including all differences caused by absence, difference in testing conditions, etc. The Gary results, therefore, nowhere depart from the official Ayres standards more than half a step.

#### AGREEMENT BETWEEN TESTS

A by-product of repeated testing is the check the results yield upon the tests themselves. Questions as to the degree of correspondence from test to test, both of class and individual scores, will now be considered.

The individual scores of 42 eighth grade children

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<sup>1</sup>The median of 20 cases was 1.3; 7 cases higher and 13 lower.

<sup>2</sup>The median of 20 cases was 3.0.

present for all tests used in the survey were compared as to scores for quality of writing in the three writing tests. In quality, 40 per cent. of the individuals maintain the same position within the group<sup>1</sup> when measured by the dictation tests as when measured by the composition test. For comparisons between the free choice test and dictation tests, the index of correspondence is the same, while the result was 86 per cent. for comparisons between the composition and free choice tests. Only one comparison for rate was possible, since in the dictation test the rate of writing was the same for all. But 29 per cent. of the children were found to maintain the same position in the group on the basis of comparison of scores in rate of writing in the composition and free choice tests (Table XIII, page 71). In other words, for the Gary children the free choice test yields samples of writing which agree closely with the quality of writing the children show in their compositions.

For the various class scores the actual differences in quality between the class result and the generalized city wide<sup>2</sup> results were found. In some classes the scores made in the composition test agree with those made in the free choice and dictation tests. In other classes there is a wide divergence between the three scores. For instance, class No. 28 Froebel, 4A grade, was, in the composition test, 2.3 points above the city wide score, the free choice 4.8 points above and in the

<sup>1</sup>See XI of Appendix A, page 480.

<sup>2</sup>See XI of Appendix A, page 473.

TABLE XIII  
RELATION BETWEEN RESULTS OF DIFFERENT TESTS<sup>1</sup>

|                  | MEDIAN |         | MEDIAN DEVIATION |         | TOTAL RANGE |         |
|------------------|--------|---------|------------------|---------|-------------|---------|
|                  | RATE   | QUALITY | RATE             | QUALITY | RATE        | QUALITY |
| Dictation.....   | —      | 37.5    | —                | 2.5     | —           | 20-65   |
| Composition..... | 59.0   | 35      | 8.2              | 5       | 26.8-32.0   | 25-55   |
| Free Choice..... | 93     | 40      | 12               | 5       | 34-125      | 20-65   |

<sup>1</sup>Based on 48 eighth grade cases.

COEFFICIENT OF CORRESPONDENCE

PERCENTAGE OF TOTAL CASES WHICH DO NOT VARY IN RELATIVE POSITION MORE THAN ONE UNIT (OR ONE HALF A UNIT) OF VARIABILITY

| TESTS                             | 1 UNIT  |      | ½ UNIT  |      |
|-----------------------------------|---------|------|---------|------|
|                                   | QUALITY | RATE | QUALITY | RATE |
| Dictation with Composition.....   | 40      | —    | 21      | —    |
| Dictation with Free Choice.....   | 40      | —    | 17      | —    |
| Composition with Free Choice..... | 86      | 29   | 86      | 12   |

TABLE 13—*Continued*

This table is to be read as follows: If the relations of the individual scores for handwriting to the class median in the dictation test are compared with the relations of the score in handwriting of the same individuals to the class median in the composition test, it will be found that 40% of the individuals maintain the same positions in the two tests within one unit of variability; that is, within 2.5 Ayres units in the dictation test and 5 Ayres units in the composition test.

Note that the coefficient of correspondence between the free choice test and the composition test is 86%. In other words, the free choice test reveals the quality of the ordinary writing of more than five sixths of the children, and, for Gary at least, is a good test.

dictation test 2.5 points above. The three tests thus confirm each other in showing that the writing done by this class is slightly above the grade level for the city as a whole. On the other hand, class No. 10 Beveridge, 5A grade, is in the composition test 3.0 points below the general level, and in the free choice test 7.5 above the general level, and in the dictation test 2.0 points above. In this case the three tests give divergent results.

If the 57 class differences in quality of writing in the composition test are compared with the corresponding differences in the free choice test it will be found that in 29 cases the class scores are either both above or both below the city wide scores; in 28 cases there is disagreement, one of the two scores being above and the other below the city wide scores. The comparison of the results from the dictation and free choice test gives almost exactly the same results, although the actual classes in

# HANDWRITING

73

TABLE XIV  
CLASS DIFFERENCES FROM CITY WIDE GENERALIZED SCORE IN QUALITY OF WRITING

| No. | SCHOOL    | CLASS No. | GRADE | QUALITY      |             |           | No. | SCHOOL    | CLASS No. | GRADE | QUALITY      |             |           |
|-----|-----------|-----------|-------|--------------|-------------|-----------|-----|-----------|-----------|-------|--------------|-------------|-----------|
|     |           |           |       | Com-position | Free Choice | Dictation |     |           |           |       | Com-position | Free Choice | Dictation |
| 1   | Freebel   | 22        | 4C    | +2.5         | -2          | +1.5      | 30  | Beveridge | 11        | 6B    | +13.0        | +3.0        | +1.0      |
| 2   | Freebel   | 32        | 4C    | -5.4         | +5.2        | +3.2      | 31  | Freebel   | 42        | 6A    | +1.4         | +1.4        | +1.4      |
| 3   | Beveridge | 8         | 4C    | -4.0         | +1.8        | -1.0      | 32  | Emerson   | 12        | 6A    | +1.5         | +3.0        | +2.4      |
| 4   | Jefferson | 9         | 4C    | +1.8         | +3.5        | +2.3      | 33  | Beveridge | 11        | 7C    | +3.4         | +6.0        | +2.0      |
| 5   | Freebel   | 24        | 4B    | +1.0         | +1.5        | +1.3      | 34  | Beveridge | 15        | 7C    | +1.7         | +1.5        | +3.4      |
| 6   | Freebel   | 8         | 4B    | -4.9         | +2.2        | -1.6      | 35  | Jefferson | 16        | 7C    | +4.8         | +3.0        | +3.4      |
| 7   | Beveridge | 12        | 4B    | +2.3         | +2.3        | -1.0      | 36  | Jefferson | 17        | 7C    | +1.0         | +1.9        | +4.5      |
| 8   | Freebel   | 28        | 4A    | +1.8         | +3.7        | +2.5      | 37  | Emerson   | 10        | 7B    | +2.0         | +3.0        | +1.2      |
| 9   | Emerson   | 9         | 4A    | +2.0         | +2.9        | +2.0      | 38  | Beveridge | 43        | 7B    | +1.3         | +7.4        | +1.2      |
| 10  | Beveridge | 9         | 4A    | -2.0         | +1.4        | +2.1      | 39  | Freebel   | 44        | 7A    | +5.5         | +1.8        | +2.0      |
| 11  | Jefferson | 12        | 4A    | +3.4         | +4.8        | +2.1      | 40  | Emerson   | 13        | 7A    | +4.0         | +3.8        | +7.0      |
| 12  | Freebel   | 29        | 5C    | +5.0         | -2.5        | +1.0      | 41  | Beveridge | 12        | 7A    | +2.0         | +3.3        | +7.4      |
| 13  | Freebel   | 30        | 5C    | +7.0         | -3.0        | +2.3      | 42  | Jefferson | 14        | 7A    | +2.0         | +2.0        | +9.0      |
| 14  | Freebel   | 31        | 5C    | +7.0         | -3.0        | +1.0      | 43  | Jefferson | 17        | 7A    | +6.2         | +2.5        | +1.0      |
| 15  | Beveridge | 9         | 5C    | +7.0         | -3.0        | +1.0      | 44  | Emerson   | 15        | 8B    | -7.4         | +2.5        | +2.0      |
| 16  | Freebel   | 11        | 5B    | +1.0         | +1.8        | -1.9      | 45  | Emerson   | 45        | 8A    | +1.0         | +4.0        | +3.7      |
| 17  | Freebel   | 37        | 5B    | +5.0         | +4.8        | -1.0      | 46  | Freebel   | 14        | 8A    | +6.3         | +4.0        | +2.0      |
| 18  | Beveridge | 10        | 5B    | +6.0         | -2.0        | -1.0      | 47  | Emerson   | 9         | 9     | +2.5         | +2.5        | +1.4      |
| 19  | Freebel   | 10        | 5B    | +2.5         | -2.8        | -2.2      | 48  | Jefferson | 9         | 9     | +2.5         | +2.5        | +1.4      |
| 20  | Freebel   | 33        | 5A    | +2.5         | -2.8        | -2.2      | 49  | Emerson   | 10        | 10    | +2.5         | +2.5        | +1.4      |
| 21  | Jefferson | 10        | 5A    | +2.5         | -2.8        | -2.2      | 50  | Freebel   | 10        | 10    | +2.5         | +2.5        | +1.4      |
| 22  | Beveridge | 15        | 5A    | +3.0         | +1.5        | +2.0      | 51  | Emerson   | 10        | 10    | +2.5         | +2.5        | +1.4      |
| 23  | Freebel   | 38        | 6C    | +1.7         | +1.3        | +1.5      | 52  | Freebel   | 11        | 11    | +2.5         | +2.5        | +1.4      |
| 24  | Beveridge | 11        | 6C    | +1.7         | +1.3        | +1.5      | 53  | Emerson   | 11        | 11    | +2.5         | +2.5        | +1.4      |
| 25  | Freebel   | 13        | 6B    | -1.0         | +1.5        | -1.3      | 54  | Freebel   | 11        | 11    | +2.5         | +2.5        | +1.4      |
| 26  | Freebel   | 39        | 6B    | -1.0         | +1.5        | -1.3      | 55  | Emerson   | 12        | 12    | +2.6         | +2.6        | +1.2      |
| 27  | Freebel   | 40        | 6B    | -1.0         | +1.5        | -1.3      | 56  | Freebel   | 12        | 12    | +2.6         | +2.6        | +1.2      |
| 28  | Freebel   | 41        | 6B    | -1.0         | +1.5        | -1.3      | 57  | Emerson   | 12        | 12    | +2.6         | +2.6        | +1.2      |

This table is to be read as follows: Class No. 22, Freebel School rated in June as a 4C class made a quality score 8.5 above the city wide generalized score for the 4C grade in the composition test, a score .3 below the general score in the free choice test, and 1.5 above in the dictation test.

TABLE XV  
DISTRIBUTIONS OF QUALITY IN HANDWRITING IN COMPOSITION TEST

| QUALITY AYRES SCALE        | NUMBER OF CHILDREN MAKING EACH SCORE IN GRADE |     |                |     |                |     |    |    |      |       | TOTAL |
|----------------------------|-----------------------------------------------|-----|----------------|-----|----------------|-----|----|----|------|-------|-------|
|                            | 4 <sup>a</sup>                                | 5   | 6 <sup>a</sup> | 7   | 8 <sup>a</sup> | 9   | 10 | 11 | 12   |       |       |
| 80                         |                                               |     |                | 1   |                | 5   | 2  | 1  | 1    | 5     |       |
| 70                         |                                               | 2   |                | 3   |                | 10  | 4  | 4  | 2    | 20    |       |
| 60                         |                                               | 1   | 3              | 4   | 4              | 35  | 11 | 9  | 3    | 45    |       |
| 50                         | 5                                             | 9   | 13             | 31  | 16             | 85  | 30 | 14 | 10   | 163   |       |
| 40                         | 20                                            | 57  | 50             | 69  | 86             | 60  | 23 | 12 | 17   | 344   |       |
| 30                         | 112                                           | 136 | 108            | 115 | 55             | 46  | 15 | 10 | 12   | 609   |       |
| 20                         | 115                                           | 85  | 25             | 8   | 8              | 1   |    | 1  |      | 243   |       |
| 10                         | 21                                            | 2   |                | 1   |                |     |    |    |      | 24    |       |
| Total Scores               | 273                                           | 262 | 199            | 232 | 119            | 167 | 85 | 51 | 45   | 1,453 |       |
| Median Quality             | 30                                            | 34  | 37             | 39  | 39             | 45  | 52 | 52 | 46   | 38    |       |
| Standard Deviation         | 8.1                                           |     |                |     | 9.2            |     |    |    | 11.9 | 11.5  |       |
| Coefficient of Variability | 27%                                           |     |                |     | 24%            |     |    |    | 26%  | 30%   |       |

<sup>a</sup>Scored by two or more judges.

The coefficient of variability figured from data in other survey reports was—Kansas City 18 per cent., Rockford, Ill., 17 per cent., Salt Lake City, 17 per cent.

This table is to be read as follows: Of 273 fourth grade children taking the composition test, 5 wrote with quality 50-60 Ayres, 20 with quality 40-50 Ayres, and so on. The median quality for the grade was 30 Ayres and the coefficient of variability was 27 per cent.

dren, one of these tests is as suitable a measure of the relative quality of handwriting as either of the others. Whether or not this would be true in other schools in which children are given a different type of training is, of course, another question, and one that cannot be settled on the basis of the present data.

#### RANGE OF INDIVIDUAL ABILITY

One other point needs to be considered, the range of ability within the class. The distributions of the grade scores for quality of writing were found together with the standard deviations for certain grades, and the coefficient of variability, based upon the same (Table XV).

The range of variation in grades four, six, and eight proved to be much less than in the other grades. But these are precisely the grades in which the papers were scored by more than one judge. In other words, the effect of multiple scoring was to reduce the apparent variability. This effect must be taken into consideration when making comparisons with results from other school systems. For instance, in Rockford, Ill., the coefficient of variability for grades five to eight is 17 per cent., which is much lower than for the Gary eighth grade results (24 per cent.), but no details are given as to the number of judgments upon which each score was based, or amount of variation in the standards of the judges, and the like.

Therefore, in making judgments in this survey, one



should be governed rather by the samples of writing shown and by the comparisons from test to test and from grade to grade than by comparisons from city to city, except where tests are used to show general relations.

## IV. SPELLING

### §I. GENERAL RESULTS

**S**PELLING, like handwriting, is an ability which is considered easily measurable, and there are several scales and tests available for the careful evaluation of the results of teaching effort. Moreover, at Gary the annual time allotment for spelling is 496 hours as compared with 482 hours, the average time allotment of fifty American cities.

#### TESTS USED

Three methods of testing spelling were used at Gary. Conventional list tests were given to measure the conventional school product of the teaching of spelling. Next, timed dictation tests were used in an attempt to control the rate of writing, to prevent deliberation and to insure both automatic spelling and attention to expression of thought. Finally, the papers written in the composition test were scored for errors in spelling. The conclusions as to spelling ability are thus based upon three very different types of results.

FIGURE 13  
WORDS IN GARY LIST SPELLING TESTS<sup>1</sup>

| GRADE 2 |        | 3        | 4          | 5          | 6           | 7            | 8             |
|---------|--------|----------|------------|------------|-------------|--------------|---------------|
| 1       | nine   | catch    | afraid     | sometimes  | often       | issue        | divide        |
| 2       | face   | black    | uncle      | declare    | stopped     | material     | principal     |
| 3       | ride   | warm     | rather     | engage     | motion      | suggest      | testimony     |
| 4       | tree   | unless   | comfort    | final      | theater     | mere         | discussion    |
| 5       | sick   | clothing | elect      | terrible   | improvement | senate       | arrangement   |
| 6       | got    | began    | aboard     | surprise   | century     | receive      | reference     |
| 7       | north  | able     | jail       | period     | total       | respectfully | evidence      |
| 8       | white  | gone     | shed       | addition   | mention     | agreement    | organization* |
| 9       | spent  | suit     | retire     | employ     | arrive      | unfortunate  | emergency*    |
| 10      | foot   | track    | refuse     | property   | supply      | majority     | appropriate   |
| 11      | blow   | watch    | district   | select     | assist      | elaborate    | sincerely     |
| 12      | block  | dash     | restrain   | connection | difference  | citizen      | athletic*     |
| 13      | spring | fell     | royal      | firm       | examination | necessary    | extreme       |
| 14      | river  | fight    | objection  | region     | particular  | divide       | immediate*    |
| 15      | plant  | stop     | pleasure   | convict    | affair      | absence      | convenience   |
| 16      | cut    | walk     | navy       | private    | neither     | testimony    | receipt*      |
| 17      | song   | grant    | population | command    | local       | celebration  | preliminary*  |
| 18      | winter | soap     | proper     | debate     | marriage    | discussion   | decision*     |
| 19      | stone  | news     | judge      | crowd      | further     | folks        | judgment*     |
| 20      | free   | small    | weather    | factory    | serious     | arrangement  | recommend*    |
| Set:    | I      | L        | O          | Q          | S           | U            | U-V-W-X-Y-Z   |
| Value†: | 77%    | 77%      | 76%        | 76%        | 76%         | 76%          | 76%           |

<sup>1</sup>These words, taken from Ayres' Scale, are the same as those in the List Test of the Cleveland Survey.

<sup>2</sup>Also given in the dictation test.

<sup>3</sup>For method by which these values were computed see Measuring the Work of the Public Schools, page 244.

## LIST TESTS

The words used in the list test were the same as those of the Cleveland Survey (Figure 13). In the figure is shown also the division of the Ayres Spelling Scale in which the words occur, and the standards of accuracy for the different grades as determined by Ayres' investigations. The words are so chosen that the accuracy of spelling should be the same from grade to grade; that is, the fourth grade children should, according to Ayres, be able to spell the words by which they are tested with the same degree of accuracy (76 per cent.) as the fifth grade children are able to spell the words in the fifth grade test (76 per cent.). In other words, the increase in difficulty in the spelling tests is supposed to keep pace exactly with the increase in spelling ability. The average<sup>1</sup> accuracy from grade to grade is thus constant.

In the Cleveland Survey there were no spelling tests in grades higher than the eighth. At Gary, however, the eighth grade words were given also to grades nine, ten, eleven, and twelve. It must be particularly noted that this repetition of the same words through several grades constitutes an entire change of method. The purpose of the change was to determine how rapidly the ability to spell the eighth grade words was developed by high school work.

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<sup>1</sup>The term "average" is used throughout this report in its popular sense—to indicate the arithmetical mean, or the sum of all the scores divided by their number.

## THE GARY SCHOOLS

The list tests were given by the room teacher in the presence of the examiner. No suggestions were made as to how the test should be conducted, other than to ask that it be given in the "usual manner." Accordingly some teachers dictated the words slowly, some rapidly.

TABLE XVI  
AVERAGE ACCURACY IN LIST WORDS

| GRADE   | GARY RESULTS         |                    | AYRES STANDARD       |                    | CLEVELAND RESULTS |
|---------|----------------------|--------------------|----------------------|--------------------|-------------------|
|         | ACTUAL GRADE AVERAGE | GENERALIZED VALUES | AVERAGE OF 84 CITIES | ACTUAL DIFFERENCES |                   |
| 2       | 51                   | 51                 | 77                   | -26                | 74                |
| 3       | 56                   | 54                 | 77                   | -21                | 78                |
| 4       | 53                   | 54                 | 76                   | -23                | 73                |
| 5       | 51                   | 54                 | 76                   | -25                | 75                |
| 6       | 58                   | 56                 | 76                   | -18                | 78                |
| 7       | 62                   | 57                 | 76                   | -14                | 76                |
| 8       | 53                   | 57                 | 76                   | -23                | 80                |
| AVERAGE | 54.9                 | 55                 | 76                   | -21                | 76                |

SCORES OF HIGH SCHOOL CLASSES IN SPELLING THE WORDS OF THE EIGHTH GRADE TEST

| Grade .....                          | 9  | 10 | 11 | 12 |
|--------------------------------------|----|----|----|----|
| Actual Score .....                   | 57 | 71 | 79 | 80 |
| Generalized Score <sup>1</sup> ..... | 60 | 69 | 77 | 80 |

<sup>1</sup> See Appendix A, page 474.

This table is to be read as follows: The average accuracy of spelling of the test words for the second grade by the second grade children at Gary was 51%. Ayres' standard score for these same words was 77%. The Gary second grade record, therefore, is 26% below the standard. The average score made by Cleveland second grade classes in spelling the same words was 74%.

Some read the words twice and gave explanations of meaning, or illustrations of use that were helpful, others did nothing but read the list of words. That is, the conditions under which the tests were given varied from room to room.

On the average, the Gary children spell the test words with an accuracy of approximately 55 per cent. (Table XVI, page 82). The scores made by the high school classes on the eighth grade words show a gradual improvement. The record of the eighth grade class on the eighth grade words is 53 per cent., but by the end of the twelfth grade the same words are spelled with 80 per cent. accuracy.

#### COMPARATIVE DATA<sup>1</sup>

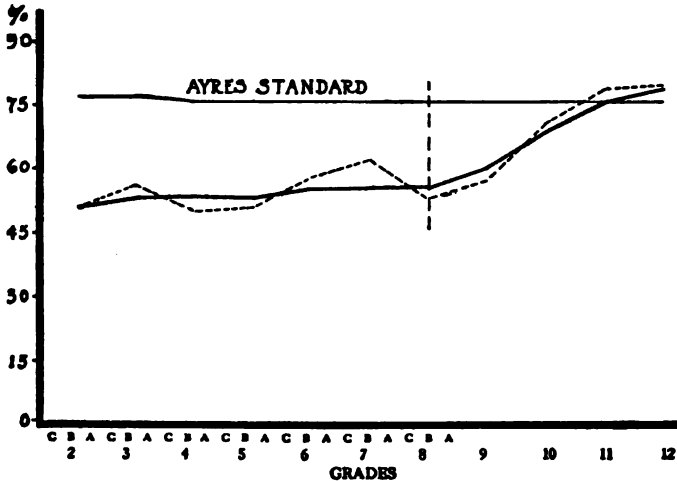
For the list tests used at Gary, general standards are available, based upon tests in eighty four American cities as well as the results obtained in the Cleveland Survey where precisely the same tests were used. For instance, Ayres' standard for the eighth grade words is 76 per cent., the eighth grade score in Cleveland was 80 per cent., the Gary score was 53 per cent. (Table XVI). The Gary averages are uniformly about 20 per cent. below Ayres' standards. That is, the Gary scores parallel the Ayres standard, but at a much lower level (Figure 14, page 84). This result in connection with the fact previously brought out in regard to the scores made by the high school classes apparently means that such of the Gary children

<sup>1</sup>See footnote, page 38.

## THE GARY SCHOOLS

FIGURE 14

GARY SCORES IN THE CLEVELAND LIST SPELLING TEST COMPARED  
WITH AYRES' STANDARDS



The scale along the base of the figure represents grades. The scale at the left of the figure shows average per cent. of accuracy of spelling. The solid line represents Gary scores (generalized). The dotted line represents actual grade averages showing variation from grade to grade. The light solid line represents Ayres' standards based upon results secured in eighty-four American cities. The portion of the curve to the right of the vertical line represents results in the high school grades in which the same eighth grade words were repeated from grade to grade.

The Gary curve parallels the curve for Ayres' standards, but at a much lower level. The eleventh grade in the high school is the first Gary grade to spell the eighth grade test words as well as the eighth grade children in the average conventional school.

In the graph as constructed the increase in difficulty of words from grade to grade is not shown. (Compare Diagram 21, *Measuring the Work of the Public Schools, Cleveland Survey.*)

TABLE XVII  
DISTRIBUTION OF CLASS AND INDIVIDUAL SCORES IN THE LIST SPELLING TESTS  
NUMBER OF EIGHTH GRADE CLASSES HAVING AN AVERAGE PER CENT. OF ACCURACY OF SPELLING OF

|           | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | TOTAL | AVERAGE SCORE |
|-----------|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-------|---------------|
| GARY      |   |   |    |    |    |    |    | 1  |    |    | 2  | 1  |    | 5  | 10 | 35 | 20 | 12 | 5  | 3  | 5     | 53            |
| CLEVELAND |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    | 90    | 80            |

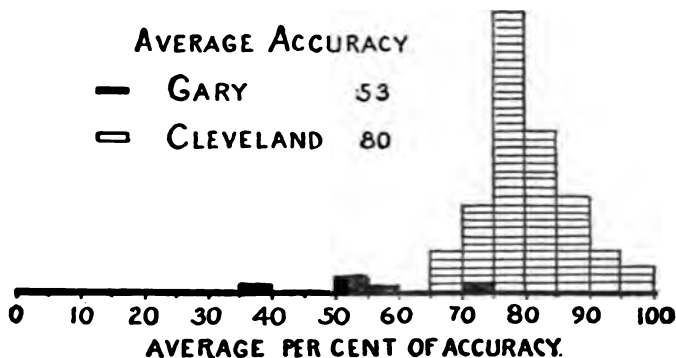
NUMBER OF EIGHTH GRADE CHILDREN IN GARY SPELLING FOLLOWING NUMBER OF WORDS CORRECTLY:

|      | 0 | 1  | 2 | 3 | 4 | 5 | 6  | 7  | 8  | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | WORDS | TOTAL |
|------|---|----|---|---|---|---|----|----|----|---|----|----|----|----|----|----|----|----|----|----|----|-------|-------|
| GARY | 4 | 10 | 3 | 3 | 4 | 9 | 10 | 10 | 13 | 9 | 1  | 9  | 13 | 12 | 9  | 8  | 8  | 9  | 3  | 6  | 2  | 147   |       |

This table is to be read as follows: Of five eighth grade classes at Gary, one in the list test made an average accuracy of 35 per cent., two of 50 per cent., and so on. In Cleveland, of 90 classes, 5 made scores of 65 per cent., 10 of 70 per cent. and so on. In the second part of the table, of 147 eighth grade children, 4 were able to spell but one word correctly, 10 two words, and so on. See also, Table XXIX in Section 2, page 130.



FIGURE 15  
EIGHTH GRADE CLASS SCORES AT CLEVELAND AND GARY IN  
SPELLING THE SAME TWENTY WORDS



Each rectangle represents the score of one class. The position of the rectangle over the scale along the base of the figure shows the average accuracy of spelling of that class. The Gary classes are shown in solid black. Four of the five Gary classes are lower than any class in Cleveland.

as remain in school eventually learn to spell the common words used in the tests as well as they are spelled by the eighth grade children in the average conventional school, but in time about three years later. Out of 90 eighth grade classes in Cleveland, only 15 have scores as low as the highest eighth grade class at Gary, while 4 out of 5 eighth grade classes at Gary are lower than any eighth grade class in Cleveland (Table XVII, Figure 15).

An inspection of the individual scores of the eighth grade children reveals the fact that about 51 per cent. of these children misspelled more than half of the twenty

test words. As measured by such list tests, therefore, the Gary children would seem to have little ability to spell the words shown in Figure 13.

#### DICTATION SPELLING TESTS

Dictation spelling tests were used to measure the development of spelling ability. Exactly the same tests were given in several successive grades. The improvement in ability from grade to grade, however, makes it impractical to continue with the same words throughout all the grades. For instance, by the fourth grade the degree of accuracy on second grade words reaches such a high level (94 per cent.) that the words are no longer an adequate test. To meet this situation, changes were made in certain grades from easy to more difficult material. In these grades the children took both the easy and the difficult test. The continuity of development in spelling ability, as revealed by the series of tests as a whole, is thus unbroken.

A second difference between the list and dictation tests should be noted. In the dictation test the words were given in sentences and a definite time allowed for the writing of each sentence. Thus the words "every" and "race" in the first test were dictated to the children in the sentence, "Every boy likes to see a race," and fourth grade children were allowed thirty two seconds in which to write it. The time allowances were changed from grade to grade to correspond to the increasing maturity of the children.

FIGURE 16

**DICTION SPELLING TESTS AND SCHEME FOR GIVING TO DIFFERENT GRADES**

**EACH TEST WAS GIVEN TO THE GRADE FOR WHICH AYRES' STANDARD PER CENT. OF ACCURACY IS GIVEN BELOW<sup>1</sup>**

| GRADES | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9  | 10 | 11 | 12 |
|--------|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|
| Test 1 | 66% | 84% | 94% |     |     |     |     |    |    |    |    |
| Test 2 |     |     | 66% | 79% | 88% |     |     |    |    |    |    |
| Test 3 |     |     |     |     | 66% | 79% | 88% |    |    |    |    |
| Test 4 |     |     |     |     |     |     | 65% | ** | ** | ** | ** |

\*\*No standards given.

**WORDS USED IN DICTION SENTENCES**

|                        | TEST 1 | TEST 2     | TEST 3      | TEST 4        |
|------------------------|--------|------------|-------------|---------------|
| 1                      | forget | beg        | victim      | judgment*     |
| 2                      | blue   | vacation   | ought       | emergency*    |
| 3                      | when   | importance | occupy      | athletic*     |
| 4                      | seven  | wait       | senate      | organization* |
| 5                      | every  | eight      | agreement   | annual        |
| 6                      | race   | complaints | entitle     | committee     |
| 7                      | why    | afraid     | government  | separate      |
| 8                      | grand  | destroy    | responsible | receipt*      |
| 9                      | girl   | spend      | Wednesday   | especially    |
| 10                     | dark   | carried    | pleasant    | recommend*    |
| 11                     | rest   | rapid      | majority    | preliminary*  |
| 12                     | life   | flight     | organize    | decision*     |
| 13                     | fine   | family     | minute      | allege        |
| 14                     | noon   | favor      | century     | principle     |
| 15                     | glad   | which      | piece       | convenient    |
| 16                     | age    | crowd      | assist      | proceed       |
| 17                     | name   | engage     | suggest     | February      |
| 18                     | still  | oblige     | serious     | cordially     |
| 19                     | made   | degree     | expense     | immediate*    |
| 20                     | near   | regard     | business    | disappoint    |
| AYRES<br>SCALE<br>SET: | J      | O-P-Q      | S-T-U       | W-X-Y-Z       |

\*Also given in list tests.

<sup>1</sup>Ayres' standards are based on words dictated in lists, untimed, and are possibly too high by 5 per cent. for words in timed sentences. This is probably offset by the fact that the tests were given in May, while the standard values are for tests given at the middle of the year. (See Judd: *Measuring the Work of the Public Schools*, page 244.)

The complete scheme for the dictation tests and the actual words used therein are shown in Figure 16. It should be noted that the dictation tests were made to supplement the list test, both in the character of the spelling product tested and in the levels of ability measured.

In general, the results from the dictation test (Table XVIII, page 90) fully confirm those from the list tests. The eighth grade scores on the easy words for the grade was 69 per cent., on the difficult words, 50 per cent. In grades two to four the total growth shown in the two year interval was 41 per cent. (second grade 42 per cent., fourth grade 83 per cent.). For grades four to six the growth was but 34 per cent., from grades six to eight 20 per cent., from grades eight to twelve 33 per cent. In other words, the results show that the growth is small from grade to grade and relatively decreases as the difficulty of the words increases. This fact is shown graphically (Figure 17, page 91) by the change in the slant of the development curves in the successive grades.

#### COMPARATIVE DATA<sup>1</sup>

The Gary results are consistently lower than the Ayres general standards. The magnitude of the difference is approximately the same as for the list tests (20 per cent. Table XVIII, Figure 17). The Gary scores are lower also than those resulting from the use in Detroit of exactly the same tests. Measurement by dictation tests thus confirms the conclusion previously

<sup>1</sup>See page 38.

## THE GARY SCHOOLS

TABLE XVIII  
AVERAGE ACCURACY IN DICTATION TESTS

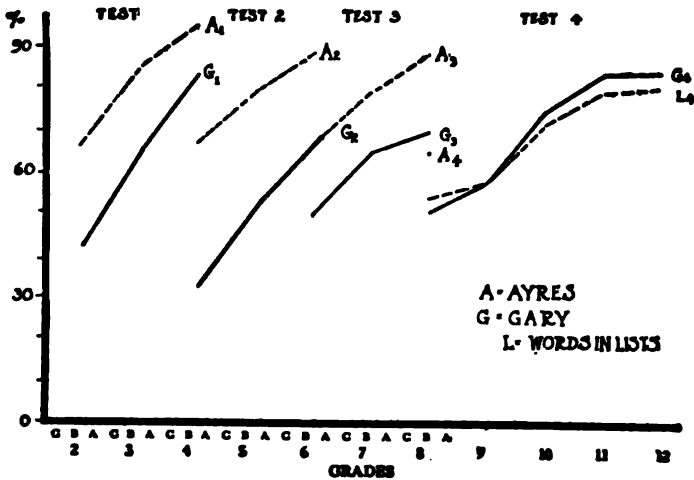
| GRADE | TEST 1 |       | TEST 2 |       | TEST 3 |       | TEST 4 |       | LAST TEST CORRELATION<br>SPENDING<br>TO NO. 4 | AYRES STANDARDS |   |   | DETROIT RESULTS |    |    |
|-------|--------|-------|--------|-------|--------|-------|--------|-------|-----------------------------------------------|-----------------|---|---|-----------------|----|----|
|       | Score  | Diff* | Score  | Diff* | Score  | Diff* | Score  | Diff* |                                               | 1               | 2 | 3 | 1               | 2  | 3  |
|       |        |       |        |       |        |       |        |       |                                               |                 |   |   |                 |    |    |
| 2     | 42     | -24   |        |       |        |       |        |       |                                               | 66              |   |   | 78              |    |    |
| 3     | 64     | -20   |        |       |        |       |        |       |                                               | 84              |   |   | 85              |    |    |
| 4     | 83     | -11   | 32     | -34   |        |       |        |       |                                               | 94              |   |   | 92              | 63 |    |
| 5     |        |       | 50     | -29   |        |       |        |       |                                               |                 |   |   |                 | 71 | 66 |
| 6     |        |       | 66     | -22   | 49     | -17   |        |       |                                               |                 |   |   |                 | 86 | 72 |
| 7     |        |       |        |       | 64     | -15   |        |       |                                               |                 |   |   |                 |    | 88 |
| 8     |        |       |        |       | 69     | -19   |        | -88   | 53                                            |                 |   |   |                 |    |    |
| 9     |        |       |        |       |        |       | 50     |       | 57                                            |                 |   |   |                 |    |    |
| 10    |        |       |        |       |        |       | 57     |       | 71                                            |                 |   |   |                 |    |    |
| 11    |        |       |        |       |        |       | 74     |       | 79                                            |                 |   |   |                 |    |    |
| 12    |        |       |        |       |        |       | 83     |       | 80                                            |                 |   |   |                 |    |    |

\*From Ayres Standard.

†Dictation Tests, January, 1916.

This table is to be read as follows: The average accuracy of the second grade in spelling Test 1 was 42 per cent., which is 24 per cent. below Ayres' standard. Detroit second grade score in the same test was 78 per cent. Note that for grades four, six, and eight, scores are given in two tests, thus the average score of the fourth grade in Test 1—the easy material—was 83 per cent., and in Test 2—the more difficult material—32 per cent. In Test 1 the Gary score was 11 per cent. below standard; in Test 2, 34 per cent. below standard.

FIGURE 17  
RESULTS OF DICTATION TESTS



Scale along the base of the figure represents grades. Scale along the vertical axis represents per cent. of accuracy in dictation tests. Solid lines represent Gary results in Test 1 (grades two, three, and four). Test 2 (grades four, five, and six). Test 3 (grades six, seven, and eight) and Test 4 (grades eight, nine, ten, eleven, and twelve). Broken line represents Ayres' standards for the words used in the dictation tests. In grades eight, nine, ten, eleven, and twelve the broken line does not represent the Ayres' standards, but the scores made by the same grades in the list tests given previously. It should be noted that in the fourth, sixth, and eighth grades, where it was necessary to change from easy to difficult words, both tests were given.

Conclusions: The Gary scores are shown to be below Ayres' standards. As the difficulty of the words increases, the slant of the development curves from lower to high grades decreases. In the fourth grade, the Gary results on the easy test exceed those of the Ayres on the hard words. In the sixth grade the Gary results on the easy words are

FIGURE 17—*Continued*

just equal to Ayres' standards on the hard words. In the eighth grade the Gary results on the easy words are very slightly above Ayres' standard for the difficult words. The four tests are, therefore, consistent in showing that the Gary children are from one to two years behind children in conventional schools in their ability to spell common words.

reached in regard to the lack of development of spelling ability in the Gary children.

#### COMPOSITION SPELLING TESTS

As a check upon the formal spelling tests, misspellings in papers written in the composition test were tabulated. The errors noted were of two sorts: slips, or trivial mistakes, such as the omission of "d" from the word "and," and more serious misspellings, such as "peise" (piece). The number of words misspelled per thousand running words was called a spelling coefficient. Thus in the eighth grade the total number of running words in 122 papers was 27,610; the total number of all misspellings was 720. Of this number, however, 140 were slips, leaving 580 words misspelled according to the rules adopted for the scoring. The spelling coefficient for total misspellings was 26.07 ( $720 \div 27.61$ ) and for the slips 5.07 ( $140 \div 27.61$ ). In other words, the general accuracy of the eighth grade spelling in the composition test was 97 per cent. ( $1.00 - .026$ ) if all the mistakes were counted, or 98 per cent. ( $1.00 - .021$ )<sup>1</sup> if slips were not considered misspellings. Thus the results from the

<sup>1</sup>( $.026 - .005 = .021$ ).

composition test seem directly to contradict the results of the formal tests in spelling.

The full degree of this apparent contradiction is shown by the actual and generalized city wide median coefficients for both slips and misspellings in each grade (Table XIX below, Figure 18, page 94.). The general accuracy of spelling is high—92 per cent. in the fourth grade,<sup>1</sup> the lowest tested—and the improvement is marked from grade to grade. The total errors in the twelfth grade

TABLE XIX

SPELLING COEFFICIENTS IN COMPOSITION TESTS

Coefficient found by dividing number of words misspelled by number of words written. Represents number of words misspelled per thousand words written. S stands for slips; M for misspellings; T for total errors. S and T are tabulated. M found by subtraction.

| GRADE | ACTUAL CITY WIDE MEDIAN |      |      | GENERALIZED SCORES |    |    |
|-------|-------------------------|------|------|--------------------|----|----|
|       | S                       | M    | T    | S                  | M  | T  |
| 4     | 16.8                    | 57.0 | 73.8 | 17.0               | 58 | 75 |
| 5     | 13.3                    | 52.6 | 65.9 | 14.0               | 51 | 65 |
| 6     | 10.6                    | 43.1 | 53.7 | 10.0               | 41 | 51 |
| 7     | 7.5                     | 24.3 | 31.8 | 8.0                | 27 | 35 |
| 8     | 6.1                     | 13.6 | 19.7 | 6.0                | 17 | 23 |
| 9     | 3.2                     | 13.9 | 17.1 | 4.0                | 13 | 17 |
| 10    | 3.4                     | 9.8  | 13.2 | 4.0                | 9  | 13 |
| 11    | .84                     | 8.56 | 9.40 | 3.0                | 7  | 10 |
| 12    | 3.0                     | 6.0  | 9.0  | 3.0                | 6  | 9  |

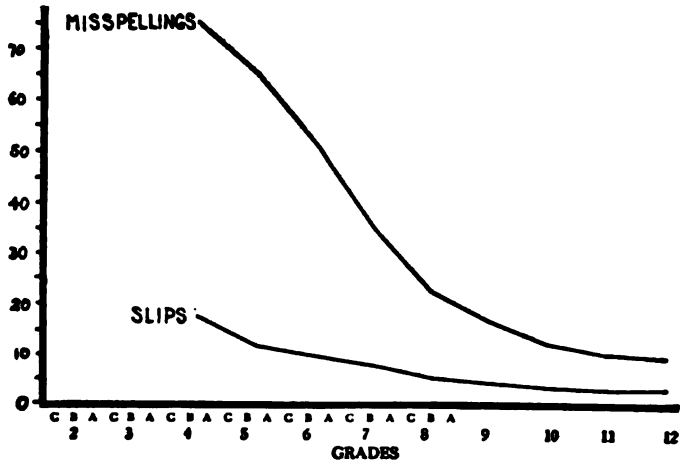
This table is to be read as follows: The fourth grade children at Gary in their compositions made 16.8 minor errors (slips) in each 1,000 words written, misspelled 57 words per thousand, or made a total of 73.8 mistakes in spelling per thousand words written. In comparison with the scores of other grades and for the purpose of smoothing the development curves, the city wide scores for the fourth grade are taken as 17, 58 and 75 respectively.

<sup>1</sup>(1.000 — .075 = .925).



## THE GARY SCHOOLS

FIGURE 18  
TOTAL ERRORS IN SPELLING



Grades are shown along the horizontal scale. The number of words misspelled per thousand along the vertical scale. The curve labelled "misspellings" is based upon total errors; that labelled "slips" upon the number of trivial errors. The true misspellings are represented by the differences between the two curves.

Note the great changes from grade to grade and the small number of errors made by high school classes. Analysis of the character of these errors would indicate that the apparent improvement is due almost entirely to avoidance by children of the use of words which they cannot spell.

amounted to but nine words misspelled per thousand words written. On the basis of such data, the spelling abilities of the children in Gary would seem to be practically perfect and the results reported in the previous tables grossly to misrepresent the true conditions.

The explanation of this apparent conflict between the

formal, and the composition, spelling tests, is a matter of inference. Careful investigation, however, makes it probable that no contradiction between the results of the various tests really exists, and that the spelling in the composition test confirms the conclusions drawn from the results of the formal tests.

In the first place it must be remembered that misspelling one word does not necessarily have the same significance that misspelling another word may have. Consequently, instead of accepting the coefficients given in Table XIX, page 93, at their face value, there must be proper evaluation, both of the words used by the children and of the words misspelled. For instance, to say that 580 words out of 27,610 were misspelled is literally true, but entirely misleading. The sum of the frequencies of use of the fifty words which occur most often is 14,598 (Table XX, page 97), or more than 50 per cent. of the total number of words used. Needless to say, misspellings of such simple words as "a," "the" and "and" are very few. If the fifty most frequent words and their repetitions were eliminated from the total list of words used, the accuracy of spelling would be lowered from 580 words misspelled in 27,610 (98 per cent. accuracy) to 543<sup>1</sup>

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<sup>1</sup>Words actually misspelled in remaining 13,012 running words. An analysis of the 31 words used in the eighth grade formal spelling tests shows that but 3 words are rated by Jones (Concrete Investigation of the Material of English Spelling. W. Franklin Jones, University of South Dakota), as of fourth, or lower grade difficulty, 7 are assigned to grades 5 or 6, 13 to grades 7 or 8, while 8 of the more difficult words do not appear in Jones' list at all.

words misspelled in 13,012 (96 per cent. accuracy). That is, the composition test may not measure ability to spell on the same level of word difficulty as the formal tests.

On the other hand, the Gary children in their compositions used mainly second grade words<sup>1</sup> (Table XXI, page 100, and Figure 19, page 101). Eighty six per cent. of the running words and 53 per cent. of the different

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<sup>1</sup>In the appendix, Sec. IV, page 406, will be found a list of the words misspelled in the Gary eighth grade compositions, excluding slips, the frequency with which they were used, and the frequency of their misspelling; also the grades in which such words are first used by 2 per cent. of the children in the conventional schools (according to Jones). The reader should examine this list and see for himself the actual words misspelled by the Gary eighth grade children. The words in Jones' "second grade" list are not necessarily easy words. In fact Jones states, "The very words that give most trouble in spelling are almost invariably found in the second or third grade lists, and faithfully reappear throughout the subsequent years." (However, see Table VIII B, Section IV, Appendix A, page 414, for the sense in which this statement is to be taken. Even the hundred "spelling demons" are easy words for the average eighth grade class.) An analysis of the first 250 words of this report (page 3) shows 43 per cent. second grade words, 5 per cent. third grade, 3 per cent. fourth grade, 3 per cent. fifth grade, and 9 per cent. sixth grade or higher, 10 per cent. N. L. D., 27 per cent. N. L. Hence, the importance of examining the actual words misspelled by the Gary eighth grade children. (If these results are compared with those on page 230, the author will seem to be using nearly as many second grade words as the Gary eighth grade children. However, it should be remembered that Table LVI is based on 2,500 different words, and the results above on 141. The larger the total number of words, the smaller the percentage of second grade words. Thus, for the 396 different words used in the first 1,000 words of this report the author's percentage of second grade words drops to 35 per cent.)

words are of second grade difficulty. Also 55 per cent. of the 376 different words misspelled and 59 per cent. of the 580 misspellings were words which are classed as second grade words in Jones' vocabularies. Whenever they did have occasion to use more difficult words, these words were usually misspelled. Thus only 11 different words ranked as eighth grade words by Jones were used in the Gary eighth grade compositions. These 11 words were used a total of eighteen times and misspelled fifteen

TABLE XX

FIFTY WORDS USED MOST FREQUENTLY IN THE EIGHTH GRADE COMPOSITIONS

| NO. | WORD | TIMES USED | NO. | WORD         | TIMES USED | NO. | WORD         | TIMES USED |
|-----|------|------------|-----|--------------|------------|-----|--------------|------------|
|     |      |            |     | <i>For'd</i> | 9,994      |     | <i>For'd</i> | 12,846     |
| 1   | the  | 1,703      | 18  | when         | 216        | 35  | me           | 133        |
| 2   | and  | 1,162      | 19  | for          | 206        | 36  | very         | 132        |
| 3   | we   | 891        | 20  | but          | 193        | 37  | am           | 129        |
| 4   | to   | 872        | 21  | one          | 191        | 38  | came         | 122        |
| 5   | a    | 756        | 22  | so           | 188        | 39  | home         | 118        |
| 6   | was  | 708        | 23  | as           | 177        | 40  | started      | 114        |
| 7   | I    | 652        | 24  | out          | 173        | 41  | us           | 113        |
| 8   | of   | 479        | 25  | all          | 162        | 42  | she          | 108        |
| 9   | in   | 452        | 26  | about        | 160        | 43  | our          | 107        |
| 10  | it   | 446        | 27  | at           | 157        | 44  | would        | 106        |
| 11  | my   | 293        | 28  | up           | 155        | 45  | with         | 100        |
| 12  | had  | 289        | 29  | got          | 152        | 46  | could        | 96         |
| 13  | were | 287        | 30  | they         | 152        | 47  | down         | 96         |
| 14  | on   | 282        | 31  | not          | 147        | 48  | after        | 94         |
| 15  | went | 244        | 32  | there        | 145        | 49  | her          | 93         |
| 16  | he   | 239        | 33  | go           | 142        | 50  | him          | 91         |
| 17  | that | 239        | 34  | then         | 136        |     |              |            |
|     |      | 9,994      |     |              | 12,846     |     |              | 14,598     |

times, so that the average accuracy of spelling was about 17 per cent.

It will be remembered that one of the spelling dictation tests given to the eighth grade (Test 3, page 88) was composed of 20 words chosen from sets S-T-U of Ayres' Scale. When the eighth grade misspellings were analyzed in terms of the Ayres' Scale (Table XXVII, page 127), it was found that 18 words almost equally distributed among sets S-T-U of Ayres' Scale had been used spontaneously by the children in their compositions. In other words, these 18 words constitute a spontaneous, self-imposed spelling test comparable with formal dictation test No. 3, the only difference being that the formal test was given to 127 eighth grade children, while at most only half this number used the words spontaneously. The correspondence in the results is almost perfect, as is shown in the following table which gives the average accuracy of spelling in the two tests:

|                       | GARY SCORE | AYRES'<br>STANDARD | DIFFERENCE |
|-----------------------|------------|--------------------|------------|
| Formal Test.....      | 69         | 88                 | —19        |
| Spontaneous Test..... | 71         | 88                 | —17        |

The apparent contradiction between the formal tests and the composition test is thus due to the fact that the Gary children in their compositions did not use many words of the same level of spelling difficulty as the formal tests.

However, there is a further point to be considered.

The fact remains that the Gary eighth grade children made very few spelling mistakes in writing their compositions. The question arises, "Is this favorable result to be credited to the Gary teaching, or does it mean that in the absence of effective training the Gary children merely followed a natural tendency to avoid words which they did not know how to spell?"

Unfortunately, the comparative data which are necessary to determine this point are not available, but one item of the results appears significant. One hundred and fifty-eight, or 42 per cent. of the words misspelled in the eighth grade compositions were misspelled also in the fourth grade compositions. That in spite of the normal increase in vocabulary which takes place from the fourth to the eighth grade, so large a proportion of the misspellings should be words which have been used, and used repeatedly, through four years of school work, tends to confirm the inference in regard to the failure of the Gary training, and to suggest that the apparent favorable results are in no way either real or a credit to the Gary system.<sup>1</sup>

In other words, the Gary eighth grade children in their compositions gave ample proof that they were unable to spell as well as the children in conventional schools the words of the Ayres' Scale which have been shown to be

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<sup>1</sup>The effect might possibly, though not probably, be due to the overlapping of grades, or the presence in the eighth grade of many children of fourth grade ability, and the presence in the fourth grade of many children of eighth grade ability.

TABLE XXI  
MISSPELLINGS (SLIPS EXCLUDED) IN EIGHTH GRADE COMPOSITIONS

| GRADE<br>ACCORDING<br>TO JONES | NO. OF<br>DIFFERENT<br>WORDS | PER CENT.<br>DIFFERENT<br>WORDS ARE<br>OF TOTAL<br>WORDS | FREQUENCY<br>OF USE | FREQUENCY<br>OF MIS-<br>SPELLINGS | PER CENT.<br>FREQUENCY OF<br>MISSPELLINGS<br>IS OF TOTAL<br>MISSPELLINGS | ACCURACY<br>OF<br>SPELLING |
|--------------------------------|------------------------------|----------------------------------------------------------|---------------------|-----------------------------------|--------------------------------------------------------------------------|----------------------------|
| 2                              | 209                          | 55                                                       | 5,746               | 344                               | 59                                                                       | 94%                        |
| 3                              | 17                           | 5                                                        | 87                  | 23                                | 4                                                                        | 74%                        |
| 4                              | 27                           | 7                                                        | 94                  | 38                                | 6                                                                        | 60%                        |
| 5                              | 14                           | 4                                                        | 38                  | 16                                | 8                                                                        | 58%                        |
| 6                              | 13                           | 3                                                        | 35                  | 17                                | 8                                                                        | 51%                        |
| 7                              | 17                           | 5                                                        | 211                 | 44                                | 8                                                                        | 79%                        |
| 8                              | 11                           | 3                                                        | 18                  | 15                                | 8                                                                        | 17%                        |
| U N L <sup>1</sup>             | 49                           | 13                                                       | 152                 | 68                                | 10                                                                       | 62%                        |
| D <sup>1</sup>                 | 19                           | 5                                                        | 45                  | 25                                | 4                                                                        | 45%                        |
| Total                          | 376                          | 100                                                      | 6,426               | 580                               | 100                                                                      | 91%                        |

<sup>1</sup> U N L = not listed. D = simple derivatives, proper nouns, etc.

This table is to be read as follows: Out of the 376 different words used a total of 6,426 times, 209 words were ranked by Jones as second grade words, were used a total of 5,746 times and misspelled 344 times. That is, 55 per cent. of the total number of words misspelled and 59 per cent. of the total frequency of misspellings were second grade words. The accuracy of spelling by eighth grade children of second grade words of their own choosing was 94 per cent.

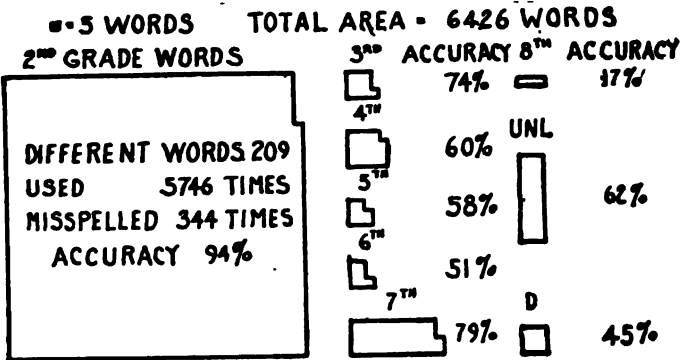
See also, Table LVI, page 231.

# SPELLING

101

FIGURE 19

CHARACTER OF THE WORDS MISPELLED IN THE EIGHTH GRADE  
COMPOSITIONS



The small square indicates the scale upon which the remaining figures are drawn and represents five words. The total area of all the other figures represent 6,426 running words, the total frequency of use of the words which were misspelled by some member of the group. The large square represents the words which are classified as second grade words by Jones. There were 209 second grade words misspelled by the eighth grade children. These words were used a total of 5,746 times, and were misspelled 344 times. The accuracy of the eighth grade spelling of the second grade words was, therefore, 94 per cent. The remaining diagrams show the relative frequency with which words classified by Jones as third, fourth, and fifth grade, etc., were used, and the relative accuracy of spelling. UNL means words which were not listed by Jones. D means derivatives, and words not counted because proper nouns, etc.

The figure as a whole shows that the words misspelled by the eighth grade children were mainly second grade words, and that as the difficulty of the words increased, the accuracy of the spelling decreased. The exception in the seventh grade is due to the frequent use of the words "exciting" and "accident" which were written on the board by the examiner in giving the instructions for the test.



the most frequently used words in the English language.

#### SCHOOL TO SCHOOL COMPARISONS

Very small differences were found in spelling ability from school to school. In general, the Beveridge and Jefferson schools, which are less completely equipped to carry out a modern program, do rather better in spelling than the two larger schools, Emerson and Froebel,

TABLE XXII

CLASS DEVIATIONS<sup>1</sup> FROM GENERALIZED CITY SCORE

| SCHOOL         | DICTATION TEST |   |    | LIST TEST      |   |    | COMPOSITION TEST—TOTAL MISSPELLINGS* |   |    |
|----------------|----------------|---|----|----------------|---|----|--------------------------------------|---|----|
|                | CLASSES TESTED | + | —  | CLASSES TESTED | + | —  | CLASSES TESTED                       | — | +  |
| Froebel. . .   | 31             | 7 | 13 | 31             | 6 | 11 | 22                                   | 1 | 14 |
| Emerson. . .   | 17             | 1 | 5  | 18             | 7 | 5  | 11                                   | 6 | 1  |
| Jefferson. . . | 18             | 2 | 6  | 18             | 8 | 5  | 13                                   | 4 | 4  |
| Beveridge. .   | 18             | 6 | 6  | 18             | 8 | 2  | 12                                   | 5 | 6  |

<sup>1</sup>Class scores which exceed by 1, the generalized city score.

\*Note that in this division of the table the plus sign indicates less ability in spelling: for the larger the coefficient the greater the number of mistakes made.

This table is to be read as follows: Of 31 classes in the Froebel school measured in spelling by the dictation test, 7 classes were markedly above the corresponding city scores, and 13 below. In the list test 6 classes were above and 11 below. In the composition test 1 class had smaller coefficients than the average for the city and 14 larger. That is, in general, the children of the Froebel school are consistently below average of the city in spelling ability, as was to be expected because of the greater amount of foreign parentage.

although the differences are relatively insignificant (Table XXII, page 102).

## §2. CRITICAL DISCUSSION

### SPELLING ABILITY

A spelling test is popularly supposed to measure a child's "general ability to spell." Many persons speak of "learning to spell" as if school training had for its purpose the development of a general ability to spell any word without regard to whether the word had ever been seen or spelled before. It is easy to show by experiment, however, that well trained adults can spell simple phonetic words which they have never seen or heard before only with an accuracy of (approximately) 30 per cent.<sup>1</sup> Therefore, the existence of general ability to spell may well be doubted.

The primary purpose of spelling is to make a written record of the sounds used in oral language. To be sure, the word may not have been sounded by the writer, and may not be sounded by the reader, but all writing is capable of being translated into sound; conversely, all oral language may be recorded by means of appropriate letters or groups of letters. In an ideal system of phonography in which each sound would be represented by a single letter, and each letter by a single sound, a person thoroughly skilled in the use of the system would, conceivably, be able to spell any word correctly, whether

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<sup>1</sup>From an unpublished Study by the Department of Educational Research, Detroit Public Schools.

or not he had ever seen or heard the word before, and even if he did not know its meaning. Under such a system school training would develop general ability. The child with little skill in using the system could spell correctly only a few words. As skill increased, the number of words spelled correctly would also increase. Finally, when the individual had attained perfection in analyzing spoken words into their sound elements and in representing each element by its appropriate symbol, the person's spelling ability would also be perfect.

Unfortunately, English words are derived from many sources and English lacks an absolute phonetic system. English is, perhaps, more illogical in its spelling than any other of the modern languages. Ability to spell in English at present means merely the ability to reproduce certain conventional symbols which stand for given words. The fact that some entire words, and parts of many words, have a phonetic basis merely increases the confusion. It may be true that phonetic analysis makes it easier to learn to spell new words, but so far as general ability to spell is concerned, our present phonetic system probably adds to the difficulty of the situation.

Hence in the English language it is quite impossible to measure directly a child's general ability to spell. The most that can be done is to measure his ability to spell certain specific words. In other words, one cannot infer with certainty that because a child is able to spell certain words correctly he will also be able to spell

correctly words of equal or less difficulty. The spelling of each word stands by itself. It is, of course, possible to test an individual with a large number of representative words and so finally determine the range of his spelling ability, but general ability to spell is seldom used with this meaning.

This point is so important and yet so often misunderstood that it merits more extended discussion. Proof of its truth will be shown by analysis of the results of tests of certain classes at Gary. In grade 7, class No. 13 Emerson and class No. 14 Jefferson made almost exactly the same average score in accuracy (71-70 per cent., respectively) in spelling 20 given words, while class No. 44 Froebel made a very much lower score (52 per cent.) in spelling the same twenty words. Fourteen of the twenty words were taken from Ayres' Scale, Set U, as being words of equal spelling difficulty as determined by the actual performances of many thousands of children. Three words were taken from the next easier set (T) and three from the next more difficult set (V). However, a mere glance at an analysis of the results by words is all that is necessary to show that while the words may be equal for seventh grade children in general, they are most certainly not equal for the children in these classes. The accuracies on individual words vary from 95 per cent. to 21 per cent. (Table XXIII, page 107). Even if the analysis be restricted to the results of the class making the best record, a variation from word to word of 35 per cent. will be found. The

probable explanation is, of course, that some of the words had been studied recently at Gary and others had not.

If a comparison of the results for the best and the worst of the three classes is made (Figure 20, page 109), the words being arranged in order of their difficulty on the basis of the per cent. of children spelling the words correctly in the class of low ability, beginning with the easiest words, it is found that this order is not the order of difficulty for the more able class. It should be noted further that in spite of the fact that the average accuracy of one class based upon the entire twenty words is 19 per cent. higher than the other (the difference between sixth, seventh, and eighth grade scores at these points of the Ayres Scale range from 9 per cent. to 15 per cent.), the more able class spells "celebration" and "respectfully" correctly less often than the less able class. If the class scores had been based upon the average of the first eight words, the results would have been 78 per cent. and 74 per cent. respectively. That is, although the two classes can spell 8 out of 20 words with nearly the same degree of accuracy, it would not be safe to infer that they could spell the other 12 words equally well, although seventh grade children, in general, are able to do so. If a similar comparison is made of the results for the two classes having closely the same average score in both tests (Figure 21, page 111), the great variation from word to word again shows that ability to spell one word is no guarantee of ability to spell another word

TABLE XXIII  
RELATIVE DIFFICULTY OF CERTAIN WORDS<sup>1</sup>

| WORD          | SET IN<br>AYRES<br>SCALE | AVERAGE<br>ACCURACY<br>AYRES | SCORES OF CLASSES |                     |                    | DIFFERENCE FROM STANDARDS |                     |                    |
|---------------|--------------------------|------------------------------|-------------------|---------------------|--------------------|---------------------------|---------------------|--------------------|
|               |                          |                              | FRANKEL<br>NO. 44 | JEFFERSON<br>NO. 14 | ENTERSON<br>NO. 13 | FRANKEL<br>NO. 44         | JEFFERSON<br>NO. 14 | ENTERSON<br>NO. 13 |
| Folk          | T                        | 79                           | 86                | 85                  | 87                 | + 7                       | + 6                 | + 8                |
| Suggest       | U                        | 73                           | 82                | 90                  | 92                 | + 9                       | +17                 | +19                |
| Respectfully  | U                        | 73                           | 82                | 76                  | 78                 | + 9                       | + 8                 | + 5                |
| Divide        | U                        | 73                           | 75                | 83                  | 81                 | + 2                       | +10                 | + 8                |
| Material      | U                        | 73                           | 71                | 88                  | 76                 | - 2                       | +10                 | + 8                |
| Issue         | U                        | 73                           | 71                | 81                  | 84                 | - 2                       | + 8                 | +11                |
| Agreement     | U                        | 73                           | 61                | 73                  | 70                 | -12                       | 0                   | - 3                |
| Celebration   | T                        | 79                           | 61                | 66                  | 59                 | -18                       | -13                 | -20                |
| Citizen       | U                        | 73                           | 54                | 95                  | 78                 | -19                       | +22                 | + 5                |
| Unfortunate   | U                        | 73                           | 50                | 63                  | 76                 | -23                       | -10                 | + 3                |
| Receive       | U                        | 73                           | 46                | 59                  | 63                 | -27                       | -14                 | - 5                |
| Absence       | T                        | 79                           | 43                | 71                  | 62                 | -36                       | - 8                 | -17                |
| Majority      | U                        | 73                           | 39                | 59                  | 59                 | -30                       | -14                 | -14                |
| Senate        | U                        | 73                           | 39                | 81                  | 63                 | -34                       | + 8                 | - 5                |
| Mere          | U                        | 73                           | 36                | 63                  | 63                 | -37                       | -10                 | - 5                |
| Arrangement   | V                        | 66                           | 36                | 42                  | 57                 | -30                       | -24                 | - 9                |
| Discussion    | V                        | 66                           | 29                | 66                  | 73                 | -37                       | 0                   | + 7                |
| Testimony     | V                        | 66                           | 29                | 59                  | 65                 | -37                       | - 7                 | + 1                |
| Necessary     | U                        | 73                           | 25                | 56                  | 59                 | -48                       | -17                 | -14                |
| Elaborate     | U                        | 73                           | 21                | 46                  | 57                 | -52                       | -27                 | -16                |
| Class Average |                          | 72.8                         | 52.0              | 69.8                | 70.8               | -21                       | - 3                 | - 2                |

<sup>1</sup> Based on scores of three seventh grade classes.

TABLE XXIII—*Continued*

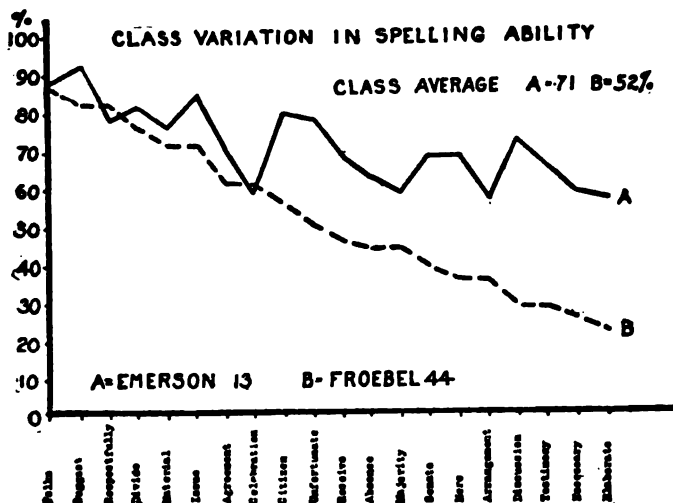
This table is to be read as follows: The word "folks" was taken from set "T" in the Ayres Scale. According to Ayres, the average accuracy of spelling the words in this set by seventh grade children is 79 per cent. Class No. 44 Froebel, however, made an average score of 86 per cent., class No. 14 Jefferson a score of 85 per cent., and class No. 13 Emerson a score of 87 per cent. That is, the score of class No. 44 Froebel was 7 per cent. above the standard, No. 14 Jefferson 6 per cent. above, and No. 13 Emerson 8 per cent. above.

The reader should note that the average score of class No. 44 Froebel on the entire twenty words was about 52 per cent., which is much below standard, while class No. 14 Jefferson and class No. 13 Emerson have closely the same score (70 and 71 per cent.). Also that No. 44 Froebel actually spelled "respectfully" and "celebration" more accurately than No. 13 Emerson, although for twelve of the words the scores of No. 44 Froebel fall very much below the scores of the other two classes.

of equal difficulty. The spelling of each word must be learned individually.

It may be objected that no word was missed by the entire class, just as no word was correctly spelled by the entire class, so that in one sense the results show merely that there are larger differences in ability to spell certain words. From this point of view, ability to spell a certain word would depend partly upon general ability to spell, and partly upon a direct knowledge of the particular word. That is, of course, true. The most difficult word of all was spelled correctly by 21 per cent. of the least able class. However, "general ability to spell" is seldom interpreted in such a sense. Any group of children reaching the seventh grade will have had so many contacts with common words and so many experiences in spelling words that the group, as a whole,

FIGURE 20  
COMPARISON OF CLASS SCORES ON INDIVIDUAL WORDS



The scale along the base of the figure shows the various words. The scale along the vertical axis of the figure shows the accuracy with which the different words were spelled. The words are arranged in the order of the accuracy with which they were spelled by Class B. That is, "folks" was the easiest word, "suggest" was the next harder word, and "elaborate" was the hardest word of all.

The solid line (A) represents results from Class No. 13, Emerson, seventh grade. The dotted line (B) represents results from Class No. 44, Froebel, seventh grade.

Average accuracy of spelling based on entire twenty words: Class A—71 per cent., Class B—52 per cent.

The curves show that the order of difficulty of words for Class B was not that for Class A. The words in the test are given as of nearly equal difficulty by Ayres. For these two classes they range in difficulty from 92 per cent. to 21 per cent. The curves also show that, although the two classes make very closely the same scores on the first eight words.



FIGURE 20—*Continued*

they differ widely on the remaining twelve words. Note that for the two words "respectfully" and "celebration" the poorer class makes higher scores than the other.

has a certain vague "general ability" to spell. In this sense the term means merely that in such a group there are sure to be some children who can spell at least part of a group of common seventh grade words.

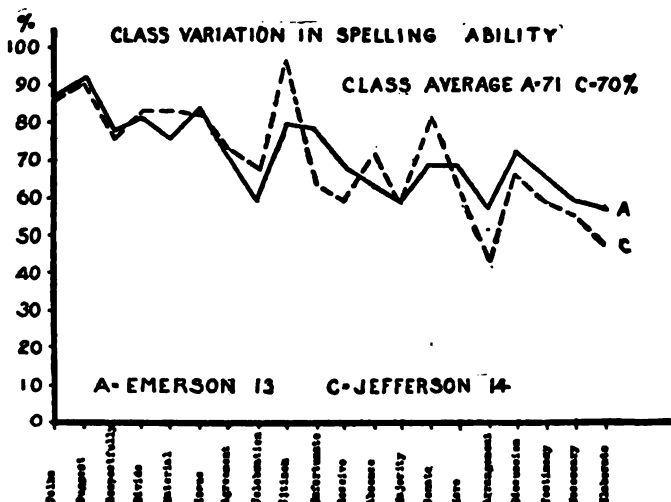
To most persons, however, general spelling ability is a term applied to the ability of individuals and implies that the individual's ability to spell seventh grade words in general may be determined by having him spell a random sampling of seventh grade words. The results shown above indicate clearly that inferences from one set of words to another set of words may be in error by amounts equal to three times the average yearly progress from grade to grade. Under the circumstances, each test consisting of but ten to twenty words must be considered by itself as a test of ability to spell certain words only.

The impossibility of making inferences in regard to an individual's ability to spell a word from his performance in spelling some other word of equal difficulty is brought out plainly by a study of the records for a single class. For instance, in class No. 13 Emerson (seventh grade) each word of the 20 in the test was missed by at least 3 of the 37 children, while no word was missed by more than 16 children. On the other hand, only 2 of the children spelled all 20 words correctly, and of the

# SPELLING

111

FIGURE 21  
COMPARISON OF CLASS SCORES ON INDIVIDUAL WORDS



The scale along the base of the figure shows the various words. The scale along the vertical axis of the figure shows the accuracy with which the different words were spelled. The order of words is the same as in Figure 20, and Curve A is taken directly from that figure. (The comparison in Figure 20 was between two seventh grade classes having very different average scores.) In this figure the comparison is between classes having almost the identical average score. In spite of this fact, the curve shows that the scores for individual words vary greatly. For instance, Class C spells "citizen" very much better than class A, but "arrangement" very much more poorly.

The solid line (A) represents results from class No. 13 Emerson, seventh grade, as in Figure 20. The dotted line (C) represents results from class No. 14 Jefferson, seventh grade.

Average accuracy of spelling based on entire twenty words: Class A—71 per cent., class C—70 per cent.

3 children who missed only one word, each missed a different word. The poor spellers of the class did not miss all the hard words, nor spell correctly all the easy words (Table XXIV, page 113).

Equally significant is a comparison of the records of those whose average accuracy in spelling the 20 words was the same as the average accuracy of the entire class. Three out of the 37 children in the class had scores of 70 per cent., while the class average was 71 per cent. That is, each of the three missed 6 words, but in no case did all three miss the same words. In only 4 cases did two of the three make the same error (Table XXV, page 115). The variation is so extreme that even to list the different words misspelled by three children of "average" ability is to list 14 out of the 20 words of the test.

Similar records could be shown indefinitely. It should be evident, therefore, that each test measures precisely only the ability to spell the words in the test and under the conditions under which it was given.

On the other hand, as data accumulate, general tendencies may become apparent, and at last inferences may be safely made in regard to the general effects of teaching effort. It should, however, never be forgotten that such inferences are inferences only, and a different choice of words or a different form of test may yield very different results. When, however, more than one form of test is used and more than one choice of words is made without bringing to light any conflicting evidence,

TABLE XXIV  
SCORES OF POOR SPELLERS COMPARED WITH CLASS SCORES<sup>1</sup>

| RANK | WORD         | AYRES<br>VALUE | ACTUAL<br>CLASS<br>ACCURACY | INDIVIDUAL RECORDS |                         |                                   |                          |
|------|--------------|----------------|-----------------------------|--------------------|-------------------------|-----------------------------------|--------------------------|
|      |              |                |                             | LOWEST SCORE       | NEXT TO LOWEST<br>SCORE | MEDIAN SCORE<br>ACCURACY<br>(75%) | SECOND ME-<br>DIAN SCORE |
| 1    | Suggest      | 73%            | 92%                         | 100%               | 100%                    | 100%                              | 100%                     |
| 2    | Folks        | 79             | 87                          | 100                | 0                       | 100                               | 0                        |
| 3    | Issue        | 73             | 84                          | 100                | 0                       | 100                               | 100                      |
| 4    | Divide       | 73             | 81                          | 100                | 100                     | 100                               | 100                      |
| 5    | Citizen      | 73             | 73                          | 0                  | 100                     | 100                               | 100                      |
| 6    | Respectfully | 73             | 78                          | 0                  | 0                       | 100                               | 100                      |
| 7    | Material     | 73             | 76                          | 0                  | 0                       | 100                               | 100                      |
| 8    | Unfortunate  | 73             | 76                          | 0                  | 0                       | 100                               | 100                      |
| 9    | Discussion   | 66             | 73                          | 100                | 0                       | 100                               | 100                      |
| 10   | Agreement    | 73             | 70                          | 0                  | 0                       | 100                               | 0                        |
| 11   | Receive      | 73             | 68                          | 0                  | 100                     | 0                                 | 100                      |
| 12   | Senate       | 73             | 68                          | 0                  | 100                     | 0                                 | 100                      |
| 13   | Mere         | 73             | 68                          | 0                  | 0                       | 100                               | 100                      |
| 14   | Testimony    | 66             | 65                          | 0                  | 0                       | 100                               | 100                      |
| 15   | Absence      | 79             | 62                          | 0                  | 100                     | 100                               | 0                        |
| 16   | Celebration  | 79             | 59                          | 0                  | 0                       | 0                                 | 100                      |
| 17   | Majority     | 73             | 59                          | 0                  | 0                       | 100                               | 0                        |
| 18   | Necessary    | 73             | 59                          | 0                  | 100                     | 100                               | 0                        |
| 19   | Elaborate    | 73             | 57                          | 0                  | 0                       | 0                                 | 100                      |
| 20   | Arrangement  | 66             | 57                          | 0                  | 0                       | 100                               | 100                      |

<sup>1</sup> Based on scores of class No. 13, seventh grade, Emerson.

## THE GARY SCHOOLS

TABLE XXIV—*Continued*

This table is to be read as follows: The easiest word for the class was "suggest." The average accuracy of spelling of this word by seventh grade children, according to Ayres, is 73 per cent. The record of class No. 13 Emerson at Gary was 92 per cent. All four individuals whose records are shown spelled the word correctly. The reader should note that while the individual in the class who had the lowest score spelled the four easiest words correctly, she also spelled the difficult word "discussion" correctly, although she misspelled the equally difficult word "arrangement." The individual who had the next to the lowest score in the class spelled correctly words of every level of difficulty, from the easiest to the third hardest, and also missed words of every level of difficulty, from the second easiest to the hardest. Similar variations are shown in the other two records.

The reader should note also that judged by the first nine words the class score is higher than Ayres' standards, although on certain words the class score is from 15 to 20 per cent. below Ayres' standards.

inferences gain a reliability they could not possibly possess if they were based upon a single test. The term "general ability of the Gary children in spelling" will be used throughout the report to mean the final inferences drawn from the series of measurement of the ability to spell particular words.

As a spelling test by itself is a reliable measure of children's performances only for the given words, the selection of test words becomes an important matter. It would be as unfair to test a school system by unusual and difficult words as it would be to use as test words only those which had recently been taught in the classroom. Fortunately, in all written English certain words are used again and again, while others appear but seldom. Ayres has made a determination of the

TABLE XXV  
MISSPELLINGS OF THREE PUPILS<sup>1</sup>

|    | WORD         | AVERAGE<br>ACCURACY<br>AYRES | AVERAGE<br>CLASS<br>ACCURACY | INDIVIDUAL RECORDS |     |      |
|----|--------------|------------------------------|------------------------------|--------------------|-----|------|
|    |              |                              |                              | A                  | B   | C    |
| 1  | Senate       | 73%                          | 68%                          | 0%                 | 0%  | 100% |
| 2  | Majority     | 73                           | 59                           | 0                  | 0   | 100  |
| 3  | Necessary    | 73                           | 59                           | 0                  | 100 | 0    |
| 4  | Celebration  | 79                           | 66                           | 100                | 0   | 0    |
| 5  | Mere         | 73                           | 68                           | 0                  | 100 | 100  |
| 6  | Respectfully | 73                           | 78                           | 0                  | 100 | 100  |
| 7  | Testimony    | 66                           | 65                           | 0                  | 100 | 100  |
| 8  | Elaborate    | 73                           | 57                           | 100                | 0   | 100  |
| 9  | Discussion   | 66                           | 73                           | 100                | 0   | 100  |
| 10 | Arrangement  | 66                           | 57                           | 100                | 0   | 100  |
| 11 | Citizen      | 73                           | 78                           | 100                | 100 | 0    |
| 12 | Agreement    | 73                           | 70                           | 100                | 100 | 0    |
| 13 | Receive      | 73                           | 68                           | 100                | 100 | 0    |
| 14 | Suggest      | 73                           | 92                           | 100                | 100 | 0    |

<sup>1</sup>These pupils had the same accuracy score as the class (70-71 per cent.).

This table is to be read as follows: The word "senate" whose average accuracy of spelling, according to Ayres, was 73 per cent., was spelled by the class with an accuracy of 68 per cent. It was misspelled by both individuals A and B, but spelled correctly by C. The reader should note that individuals A, B, and C have the same average accuracy on the 20 words (70 per cent.), and this accuracy is the same as the average made by the class as a whole on the 20 words (71 per cent.). The three individuals, however, did not miss the same word, and in only four cases—the first four words in the table—did two of them miss the same word. To record the different words misspelled by these three individuals of average ability it is necessary to list 14 words, although each of the children misspelled but 6 words.

common words, and has also found the average accuracy with which they are spelled by American school children. As one of the main functions of the teaching of spelling must be to give children the ability to spell words which they use frequently, all test words were chosen from the Ayres Spelling Scale.

#### LIST TESTS

The conventional form of school examination of spelling ability is spelling words in lists. It has no counterpart in daily life. When a list of words is dictated slowly the child has time to recall consciously the possible ways of spelling a word. He has opportunity to work out by rule, by guess work, or by reasoning from analogy both the letters he uses and their order. The word actually written on the paper tells merely that the mental process employed by the child—automatic response, reason, or guess—has in the particular instance yielded the correct result.

Spelling in daily life, however, has not this character. If one is conscious that he is uncertain of the spelling of a word, he consults a dictionary. The errors actually made are thus in automatic, unconscious spelling when the attention is concentrated upon the thought to be expressed so that the errors are unnoticed. It would seem, therefore, that a test to be a real test of spelling ability must be given under such conditions that the results would reveal not whether children know how to spell words correctly, but whether or not their actual

spelling habits when writing freely are correct. This is the reason for the use of more than one test.

**DICTATION TESTS**

The timed dictation of sentences is an unusual form of spelling test and a few points in regard to their construction need explanation.

The tests consisted of ten sentences, each containing two test words. The sentences in any one test were made of equal length within approximately five letters and care was taken to employ no words of greater spelling difficulty than the test words. The rate of dictation was controlled, each grade being given the material and rate corresponding to the median rate of free writing at its grade. That is, the test was given for the purpose of determining how many of the children could spell the given words when writing rapidly.

A defect in this series of tests was that while most of the sentences were natural, a few were markedly artificial, due to the necessity of using certain words. Again, some of the test words occurred at the end of the sentence. The child who is naturally slow, and who in such a test is compelled to write at a rate higher than his natural rate, tends to omit the last words of the sentence. Such omissions were counted as misspellings. The test words should all have occurred at the beginning or middle of sentences.

Tabulations were made of the number of words omitted by children in the classes making the lowest scores in



TABLE XXVI  
MISTAKES IN DICTATION SPELLING TESTS BY CLASS LOWEST IN ACCURACY

| GRADE                                  | TOTAL<br>NO. IN<br>CLASS | NO. OF CHILDREN<br>MAKING EACH<br>TYPE OF<br>MISTAKE |    |    |   |             | AVERAGE NUMBER OF MISTAKES OF EACH<br>TYPE PER CHILD |                    |           |                   |      | ACCURACY<br>IN<br>SPELLING |
|----------------------------------------|--------------------------|------------------------------------------------------|----|----|---|-------------|------------------------------------------------------|--------------------|-----------|-------------------|------|----------------------------|
|                                        |                          | M                                                    | O  | W  | I | MISSPELLING | OMIS-<br>SIONS                                       | SUBSTI-<br>TUTIONS | ILLEGIBLE | TOTAL<br>MISTAKES |      |                            |
|                                        |                          |                                                      |    |    |   |             |                                                      |                    |           |                   |      |                            |
| 2                                      | 20                       | 19                                                   | 18 | 7  | 3 | 6.9         | 8.5                                                  | .6                 | .9        | 16.9              | 15.5 |                            |
| 3                                      | 32                       | 18                                                   | 10 | 28 | 1 | 7.5         | .9                                                   | 2.2                | .5        | 11.1              | 44.5 |                            |
| 4                                      | 24                       | 18                                                   | 17 | 18 | 4 | 6.5         | 5.2                                                  | 1.3                | .2        | 13.2              | 34.0 |                            |
| 5                                      | 26                       | 25                                                   | 22 | 21 | 2 | 7.5         | 6.1                                                  | 2.0                | .1        | 14.7              | 26.5 |                            |
| 6                                      | 33                       | 32                                                   | 10 | 15 | 5 | 9.1         | .7                                                   | .6                 | .2        | 10.6              | 47.0 |                            |
| 7                                      | 36                       | 35                                                   | 9  | 10 | 8 | 5.7         | .6                                                   | .3                 | .2        | 6.8               | 66.0 |                            |
| 8                                      | 16                       | 16                                                   | 5  | 7  | 1 | 10.5        | .5                                                   | .5                 | .1        | 11.6              | 42.0 |                            |
| Highest<br>Accuracy<br>Second<br>Grade | 31                       | 12                                                   | 9  | 30 | 0 | 7.2         | .4                                                   | .9                 | 0         | 8.5               | 57.5 |                            |

M = Words Misspelled.

O = Words Omitted.

W = Words substituted by the child for words pronounced by the teacher, as "brand" for "grand."

I = Illegible.

TABLE XXVI—*Continued*

The table is to be read as follows: In the second grade class having the lowest accuracy there were 20 children. Of these, 19 misspelled one or more words, 18 omitted one or more words, 3 wrote one or more words illegibly, 7 substituted words for the words pronounced by the teacher. On 20 words the average mistakes in spelling were 6.9 words, in omissions 8.5 words, in substitutions .6 of a word, in illegibility .9 of a word. Total errors were 16.9, making the average accuracy 15.5 per cent. The omissions and substitutions are large only in those classes where the average accuracy is lower than 50 per cent. Note the record of even the second grade class when the class average was 57.5 per cent.

each grade (Table XXVI, page 118). The maximum effect due to the omission of words is less than one word, or 5 per cent., except in classes where the accuracy of spelling falls below 50 per cent. In such cases, as Ayres has pointed out, the test ceases to be a spelling test and becomes a guessing contest. Only when more than half the children in a class are unfamiliar with a word are the omissions large. From the scores of children in other cities, it was not expected that the scores of the Gary children in any test would fall below the 50 per cent. level. Actual conditions were not foreseen in planning the test.

It must be remembered, also, that a large number of the omissions are really due to misspellings. When a child has to "stop and think" how a word is spelled, he is not able to spell, as spelling is defined in this test. The omission of words to catch up is, therefore, equivalent to misspelling. There may be some, however, who are unwilling to accept this point of view. They should

base their conclusions on the list tests which are untimed. Nevertheless, it is the opinion of the writer that the real value of a spelling test does not lie in the certainty with which the children show their maximum ability, but in the certainty with which it points out those children who fail to spell correctly in their ordinary written work.

#### COMPOSITION TEST

In checking the results of the different examiners for the same papers in the composition test, it was noted that there were frequent disagreements as to which words were misspelled. Some of the differences were due to mere errors in reading on the part of the scorers, but many were due to the inability of the examiners to agree as to what constituted misspelling. Finally, after repeated conferences of the scorers, definitions of misspellings and a number of arbitrary rules were adopted. The papers were then scored independently by two observers. Each of the two made a list of misspelled words without in any way marking the papers himself. The two lists were then compared by a third person, and all differences in scoring by the first two examiners were checked by this third person by reference to the original papers. In this way the scoring was made reliable, although perfection in scoring proved to be very difficult to attain. In considering results from

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<sup>1</sup>Those interested in this point should note the correlations given in Table XXX, page 133.

similar tests in other school systems as a basis for comparison, it would be necessary to inquire whether equal care had been taken before such comparison could be considered valid.

The definition of misspelling finally adopted was the following:

Any variations of the character, number, or order of the letters called for in a given situation, except those which are plainly caused by grammatical errors, are to be considered misspellings and marked "E."

The part of this definition to be particularly noted is that the scorers were unable to decide whether or not a given word was misspelled by examination of the letters alone. The whole situation had to be considered. This will become plain as each qualifying rule is discussed. The following rules were adopted and used in marking the papers:

- (1) Make no record of any questionable grammatical errors.

If a child wrote, "I only done my duty," the substitution of "done" for "did" was considered a grammatical error, and not an error in spelling.

In cases of doubt, the rule gives the child the benefit of the doubt.

- (2) Regard all words in which illegible letters occur as misspelled, marking them "L".

Illegibility caused by poor writing thus operates to increase misspelling.

- (3) Errors in simple words caused by the addition or omission of common letters, prefixes or suffixes, are to be counted as slips and marked "S."

Illustration: "I walk home an ate my dinner," the omission of "ed" on *walked* and of "d" on *and* will be marked "S" for slips.

A slip is caused by some form of inattention and is ordinarily a defect of the writing activity. It may not indicate lack of knowledge of how to spell, but is, nevertheless, an error in spelling. The examiners were divided in their opinions. Some contended that spelling ability is to be measured not by slips, but by errors in words of importance. The matter was adjusted as follows: Every error of any sort was noted. One tabulation was made of the total errors, and a second one of the slips alone. It is thus possible for the reader to decide the point for himself. But whether slips are to be counted as misspellings or not, it is certain that they reveal one characteristic of the training. A well trained, careful child does not make such slips any more than he misspells words. A change in the number of slips from grade to grade is thus as much of an indication of the efficiency of training as

a change in the number of words misspelled.

Since a certain element of subjective judgment had to be reckoned with in the determination of which mistakes were to be considered slips, all doubtful cases were passed upon by three judges. No hard and fast line could be drawn between true misspellings and slips, but the restrictions given in the rule were adhered to throughout.

- (4) The substitution of one homonym for another is to be counted as a misspelling.

Illustration: *Their* for *there*, *fairy* for *ferry*, were counted misspellings, even though the words actually appearing on the papers were correctly spelled.

- (5) The substitution of one word for another, as *lighting* for *lightening*, is to be decided in each case on its merits.

If the context shows that the child made a mistake in the selection of the word to express his thoughts, no record is to be made of the mistake; but if the word in question is incorrect because of faulty spelling, it is to be counted as a misspelling, and marked "M".

Decision in these cases again involved subjective judgment, but as above, ques-

## THE GARY SCHOOLS

tionable cases were passed by three judges.

The number of such substitutions was not large.

- (6) Slight changes in common words will be marked as misspellings and not as slips.

For example: *than* for *them*; *were* for *where*, etc.

- (7) The omission of hyphens in compound words, the separation of words into parts, as "some where," or the faulty division of words at the end of a line, are not to be counted as misspellings if both parts of the word are correctly spelled.
- (8) Proper names of unknown persons will be accepted as spelled correctly, but all misspellings of well known proper names will be recorded.

"Wasington" as the name of a boy playmate was accepted as correct, but as the name of the first President of the United States was counted misspelled.

- (9) Faulty use of capitals, omissions of dots over "i's" or crosses over "t's" are not to be counted either as misspellings or slips.

After the spelling errors in the compositions had been determined by the above rules, the tabulations brought up an added difficulty. Children wrote papers of varying lengths, so that the possibility of error differed greatly. To reduce the results to a comparable basis, a coefficient of misspellings was computed for each child.

This coefficient was taken as the number of words misspelled per thousand words written; that is, the actual number of errors in spelling was divided by the total number of words written, and the division carried to the nearest thousandth. A tabulation of a random selection of cases proved that there was no relation between the length of a paper and the size of the coefficient of misspellings: consequently the values thus determined were accepted as a measure of spelling ability.

It should be remembered, however, that such a measure is a gross measure only. To misspell a word written correctly by most of the other children in a grade is a much more serious error than misspelling an unusual word. A truly significant coefficient of spelling ability should be based upon the relative seriousness of the various misspellings. However, as no information bearing on this point was available, the gross coefficient was accepted at its face value. Hence the actual misspellings were also listed and analyzed.

An analysis of the words misspelled by the Gary eighth grade children in their compositions on the basis of Jones' vocabulary list is given in § 1 of this chapter. A similar analysis was made on the basis of Ayres' Spelling Scale. There are fewer words common to the Ayres Scale and the compositions than there are to Jones' lists and the compositions, but the tabulation fully confirms the conclusions reached previously (Table XXVII, page 127). The results show plainly that as the difficulty



of the words increases the Gary scores fall more and more below Ayres' standard.

It may be objected that Ayres' standards are too high. They represent, however, the average scores made by the children of eighty four representative American cities, and are not standards arbitrarily set. To be sure, the tests by which the standards were determined were given under conditions no more uniform than can be secured by the transmission of instructions in correspondence. The standards have, however, been repeatedly checked by subsequent tests under carefully controlled conditions and have proved valid (Table XXVIII, page 128). The values set by Ayres approximate the values which represent the average spelling ability of children in various cities of the United States. The differences from Ayres' standards are small, and vary from grade to grade. In some cases they are negative, and in others positive. Many cities, indeed, show an average difference which is positive, and in amount equal to from 4 per cent. to 12 per cent. On the whole, therefore, comparisons with Ayres' standards are valid.

#### RANGE OF ABILITY

In discussing the results of educational tests the variation of individual ability within the grade is almost as much a matter of concern as the class score. A well graded, efficient system, meeting the needs of individuals at every turn, may be expected to have compact grades

TABLE XXVII  
MISSPELLINGS IN EIGHTH GRADE COMPOSITIONS

| SET<br>ACCORDING<br>TO AYRES | NUMBER<br>OF<br>WORDS | FREQUENCY<br>OF USE | FREQUENCY<br>OF MIS-<br>SPELLING | PER<br>CENT. OF<br>NUMBER | PER CENT.<br>OF TOTAL<br>FREQUENCY | GARY<br>ACCURACY | AYRES'<br>STANDARD | DIFFER-<br>ENCE |
|------------------------------|-----------------------|---------------------|----------------------------------|---------------------------|------------------------------------|------------------|--------------------|-----------------|
| A-M                          | 92                    | 4,484               | 150                              | 24                        | 70                                 | 97               | 100                | -8              |
| N                            | 14                    | 304                 | 83                               | 4                         | 5                                  | 89               | 100                | -11             |
| O                            | 9                     | 135                 | 14                               | 3                         | 2                                  | 99               | 99                 | -9              |
| P                            | 12                    | 153                 | 15                               | 3                         | 2                                  | 90               | 98                 | -8              |
| Q                            | 7                     | 97                  | 13                               | 2                         | 2                                  | 87               | 96                 | -9              |
| R                            | 10                    | 51                  | 12                               | 3                         | 1                                  | 77               | 94                 | -17             |
| S                            | 5                     | 63                  | 21                               | 1                         | 1                                  | 67               | 92                 | -25             |
| T                            | 6                     | 60                  | 9                                | 2                         | 1                                  | 85               | 88                 | -3              |
| U                            | 7                     | 31                  | 15                               | 2                         | —                                  | 52               | 84                 | -32             |
| V                            | 1                     | 1                   | 1                                | —                         | —                                  | —                | 79                 | -79             |
| X                            | 1                     | 1                   | 1                                | —                         | —                                  | —                | 66                 | -66             |
| Not Listed                   | 194                   | 1,007               | 273                              | 51                        | 16                                 | 73               | —                  | —               |
| N. L. D.                     | 18                    | 89                  | 23                               | 5                         | —                                  | 41               | —                  | —               |
| Total                        | 376                   | 6,426               | 580                              | 100                       | 100                                | 91               | —                  | —               |

This table is to be read as follows: Out of the 376 different words which were misspelled in the eighth grade compositions (these words were used a total of 6,426 times), there were 92 words found in Ayres' Scale in Sets A to M. These 92 words were used a total of 4,484 times and misspelled a total of 150 times. That is, these words make up 24 per cent. of the total number of different words misspelled, and 70 per cent. of the total frequency of use. The average accuracy with which they were spelled was 97 per cent. (100-150/4,484). Ayres' standard for the same words is 100 per cent. That is, the spelling ability of the Gary children for the simplest words is 3 per cent. below Ayres' standards.

## THE GARY SCHOOLS

TABLE XXVIII  
VALIDITY OF AYRES' STANDARDS

| CITY                   | GARY                             | CLEVELAND | SPRINGFIELD,<br>ILL. | BUTTE                            | SALT LAKE<br>CITY | OAKLAND                       | KANSAS CITY |
|------------------------|----------------------------------|-----------|----------------------|----------------------------------|-------------------|-------------------------------|-------------|
| Number of<br>Children: | 2,533                            | 52,536    | 3,612                | 1,504                            | 3,988             | 12,985                        | 18,720      |
| Examiners:             | Teachers                         | Teachers  | ?                    | Teachers                         | Teachers          | Teachers                      | ?           |
| Scores:                | Children,<br>checked<br>by staff | Teachers  | ?                    | Teachers,<br>checked<br>by staff | Teachers          | Teachers<br>and Stu-<br>dents | ?           |
| GRADE 2                | -26                              | -3        | 0                    | +16                              | -                 | -10                           | +9.2        |
| 3                      | -21                              | +1        | -5                   | +12                              | +20               | -3                            | +10.2       |
| 4                      | -23                              | -3        | 0                    | +9                               | +9                | +6                            | +8.3        |
| 5                      | -25                              | -1        | +2                   | +14                              | +8                | +15                           | +14.5       |
| 6                      | -18                              | +2        | -2                   | +5                               | +7                | +10                           | +9.4        |
| 7                      | -14                              | 0         | +3                   | +6                               | +7                | +10                           | +11.6       |
| 8                      | -23                              | +4        | +5                   | +19                              | +2                | +6                            | -           |
| Average...             | -21                              | 0         | + .4                 | +11.5                            | + 8.8             | + 4.8                         | +10.5       |

This table is to be read as follows: The use of words from the Ayres Scale gave for the second grade results which, in the Gary Survey, were 26 per cent. below Ayres' Standard; in Cleveland, 3 per cent. below Ayres' Standard; in Springfield, the same as Ayres' standard; in Butte, 16 per cent. above Ayres' standard; in Oakland, 10 per cent. below Ayres' standard; and in Kansas City, 9.2 per cent. above Ayres' standard.

of low variability. The range of variation within the grades at Gary is very great and the coefficients of variability large (Table XXIX, page 130).

#### RELATION BETWEEN TESTS

A series of measurements of a single type of ability affords an opportunity for a study of the relation between the tests used. A number of interesting questions suggest themselves. Are the children who make low scores in the formal spelling tests those who misspell the largest number of words in their compositions? Will a dictation test or a list test reveal most accurately the children who make errors in spelling in their compositions?

The scores of the children in the list and dictation tests show a greater correspondence than do the scores from any other two of the tests (Table XXX, page 133). Eighty eight per cent. of the 42 eighth grade children present for all tests maintain their place in the two distributions within one unit of variability. That is, 9 children out of 10 will be as much above or below the median of the group, relatively, in one test as in the other. The reader will, of course, note that the median deviation for these two tests was 24 per cent. and 20 per cent. respectively. If, however, the limit of variation be reduced to half that figure, 60 per cent. of the children will be found to maintain the same relative place in the distribution whether measured by one test or the other.

The correspondence between actual mistakes in spelling and the mistakes in the formal tests is such that three

TABLE XXIX  
DISTRIBUTION OF INDIVIDUAL EIGHTH GRADE SCORES

| ACCURACY SCORE % | LIST TEST |                     | DICTATION TEST      |                         | COMPOSITION TEST   |                           |  |
|------------------|-----------|---------------------|---------------------|-------------------------|--------------------|---------------------------|--|
|                  | FREQUENCY | TEST 3<br>FREQUENCY | TEST 4<br>FREQUENCY | SPELLING<br>COEFFICIENT | SLIPS<br>FREQUENCY | TOTAL ERRORS<br>FREQUENCY |  |
| 100              | 2         | 15                  | 0                   | 0                       | 99                 | 33                        |  |
| 95               | 6         | 16                  | 0                   | 10                      | 12                 | 29                        |  |
| 90               | 3         | 11                  | 2                   | 20                      | 5                  | 26                        |  |
| 85               | 9         | 13                  | 6                   | 30                      | 5                  | 14                        |  |
| 80               | 8         | 12                  | 4                   | 40                      | 0                  | 1                         |  |
| 75               | 9         | 9                   | 4                   | 50                      | 0                  | 7                         |  |
| 70               | 12        | 7                   | 8                   | 60                      | 1                  | 3                         |  |
| 65               | 13        | 9                   | 0                   | 70                      |                    | 2                         |  |
| 60               | 9         | 8                   | 6                   | 80                      |                    | 3                         |  |
| 55               | 1         | 8                   | 5                   | 90                      |                    | 1                         |  |
| 50               | 9         | 5                   | 1                   | 100                     |                    | 0                         |  |
| 45               | 13        | 4                   | 7                   | 110                     |                    | 0                         |  |
| 40               | 10        | 8                   | 5                   | 120                     |                    | 1                         |  |
| 35               | 10        | 4                   | 8                   | 130                     |                    | 0                         |  |
| 30               | 9         | 2                   | 6                   | 140                     |                    | 1                         |  |
| 25               | 4         | 3                   | 3                   | 150                     |                    | 1                         |  |
| 20               | 3         | 3                   | 4                   | 160                     |                    | 1                         |  |
| 15               | 3         | 3                   | 3                   | 170                     |                    | 1                         |  |
| 10               | 10        | 1                   | 2                   | 180                     |                    |                           |  |
| 5                | 4         | 2                   | 0                   | 190                     |                    |                           |  |
| 0                |           |                     | 2                   | 200                     |                    |                           |  |

|                 |     |     |     |                |      |
|-----------------|-----|-----|-----|----------------|------|
| Total. ....     | 147 | 143 | 76  | Total. ....    | 122  |
| Average. ....   | 53% | 69% | 49% | Median. ....   | 6.2  |
| Ayres' Standard | 76% | 88% | 65% | Median Dev. .  | 3.0  |
| Average Dev. .  | 22% | 21% | 20% | Standard Dev.  | 8.5  |
| Standard Dev. . | 25% | 25% | 24% | Coefficient of |      |
| Coefficient of  |     |     |     | Variability .. | 137% |
| Variability. .  | 47% | 36% | 49% |                | 136% |

This table is to be read as follows: Of 147 eighth grade children who took the list spelling test, 2 spelled every word correctly, 6 had a score of 95 per cent., and so on. The average score of the class was 53 per cent. Ayres' standard for the same words was 76 per cent. The average deviation of the individual score from the class average was 22 per cent. and the standard deviation was 25 per cent. In other words, the range of ability within the grade is large, so that a child selected at random will, on the average, have a score 20-25 per cent. larger or smaller than the class score. The standard deviation is 47 per cent. of the class average.

Coefficient of variability of eighth grade at Rochester, N. Y., based on results from list test used at Gary, is 8A—15 per cent., 8B—18 per cent. Data from report of J. P. O'Hern, Asst. Supt. of Schools.

fourths of the children maintain their relative places in the two distributions. The correspondence is slightly greater between the misspellings in the compositions and the dictation test<sup>1</sup> than it is for the list test, but the differences are scarcely significant. If slips alone be considered, the correspondence with the scores in the dictation test is considerably closer than with the scores in the list tests, but if the total errors are to be considered, the relative merits of the two tests are exactly reversed. That is, the children who make slips in their compositions are the children who misspell in the dictation test, rather than those who miss in the list test; but if the combined scores of slips and misspellings be counted, the correspondence between total errors in the composition test and scores in the list test is slightly greater than the correspondence between the total errors in the composition test and scores in the dictation test. If the limit of variation be restricted to half a unit of variability, these relations are altered very slightly. On the whole, therefore, judgments as to the way children will spell in their compositions, based upon either a list or dictation test, are fairly reliable.

Those unfamiliar with statistical methods will find the graphic record shown in Figure 22 on page 135 a more satisfactory basis for judging of the relation between the three sets of scores. While in general the correspondence

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<sup>1</sup>The Pearson Coefficient of Correlation for the relation between misspellings and scores in the dictation test for these same 42 children is .67 (probable error .06).

TABLE XXX

COEFFICIENTS OF CORRESPONDENCE IN DIFFERENT TRIALS OF SPELLING TESTS<sup>1</sup>

|                         | CLASS<br>AVERAGE | MEDIAN<br>INDIVIDUAL<br>DEVIATION<br>FROM AVERAGE | TOTAL RANGE<br>OF SCORE |
|-------------------------|------------------|---------------------------------------------------|-------------------------|
| S = Slips. ....         | 5                | 5                                                 | 0—81                    |
| M = Misspellings. ....  | 22               | 14                                                | 0—87                    |
| T = Total Mistakes. . . | 27               | 15                                                | 0—88                    |
| L = List Test. ....     | 51               | 24                                                | 5—100                   |
| D = Dictation Test....  | 70               | 20                                                | 10—100                  |

<sup>1</sup>Based on the scores of 48 eighth grade pupils.

COEFFICIENTS OF CORRESPONDENCE

Percentage of Total Cases Which Do Not Vary in Relative Position, in the Two Distributions Compared, More Than] One (or one half) Unit of Variability.

| 1 UNIT |    |    |    |    |    | $\frac{1}{2}$ UNIT |    |    |    |    |    |
|--------|----|----|----|----|----|--------------------|----|----|----|----|----|
|        | S  | M  | T  | L  | D  |                    | S  | M  | T  | L  | D  |
| S      | —  | 48 | 45 | 48 | 62 | S                  | —  | 24 | 19 | 20 | 31 |
| M      | 48 | —  | 88 | 74 | 78 | M                  | 24 | —  | 74 | 45 | 38 |
| T      | 45 | 88 | —  | 67 | 64 | T                  | 19 | 74 | —  | 34 | 40 |
| L      | 48 | 74 | 67 | —  | 88 | L                  | 20 | 45 | 34 | —  | 60 |
| D      | 62 | 78 | 64 | 88 | —  | D                  | 31 | 38 | 40 | 60 | —  |

This table is to be read as follows: If the relation of the scores of individual children in number of slips made in their compositions to the median number made by the class as a whole be compared with the relation of the same individual scores in misspellings to the median number of misspellings made by the class as a whole, 48 per cent. of the children will be found to have maintained the same relative position in the two sets of scores within one unit of variability; that is, within 5 slips, or 14 misspellings.

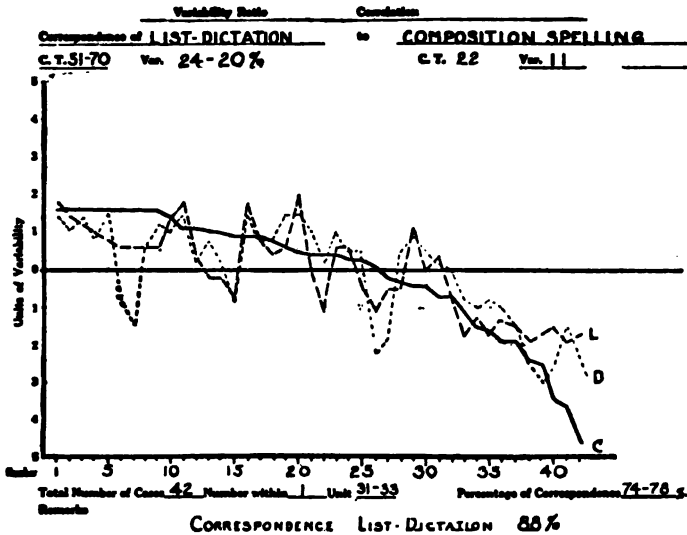


between scores in the composition test and the score in the formal spelling test is relatively close, there are among these 42 individuals some 5 or 6 who do better in their compositions than their scores in the list tests would warrant, and about the same number who do better in their formal tests than their spelling in the compositions would warrant. That is, spelling ability is specific, not general, and performance in any one test is dependent upon so many factors that performance in a single test is not a reliable basis from which to judge of an individual's performance in a related test. However, if the two tests are closely alike, as for instance, list and dictation tests, the inference will be more reliable than from performance in one test to performance in a test of totally different character, as from performance in a list test to performance in a composition test.

The list test and the dictation test upon which these computations were based (Table XXX, page 133) were of very different degrees of difficulty, one being composed of words which were easy for the grade, and the other of words which were difficult for the grade. Search through the records of various classes brought to light one class in which the records in the dictation test and the list test were closely the same. This was class No. 11, Emerson, rated as a fourth grade class in June, 1916. The average score in the list test was 55 per cent. and in the dictation test 61 per cent. The coefficients of correspondence based on the scores of this class were also computed (Table XXXI, page 138). In this case the relations shown in the

FIGURE 22

COMPARATIVE ABILITIES IN LIST, DICTATION AND COMPOSITION TESTS



The scale along the base of the figure represents individuals—42 eighth grade pupils in all. The scale along the vertical axis represents the position of the individuals in the distribution. The line marked zero represents the class median. The lines marked 1, 2, 3, 4, and 5 above or below the median line represent differences from the median equal to one unit of variability (in this case, the median deviation of individual scores from the class median).

For each individual the score made in each of the three tests is indicated by the lines. Individuals are arranged in order of their performance in the composition test; that is, individuals 1 to 8 had no mistakes in spelling in their compositions, individual 42 had 87 mistakes in spelling per hundred words written in his composition.

The broken line is based upon accuracy of spelling in the list test.

FIGURE 22—*Continued*

The scores range from individual 20, who missed none of the 20 words, to that of individual 41, who missed 19 of the 20 words.

The dotted line represents the scores made in the dictation test. The scores range from those of individual 16, who missed none of the words, to individual 39, who missed 19 of the 20 words.

It is possible to tell from the figure for any one individual his relative position in the class for each of the three tests: thus, individual 11 stood very high in the list test, not quite so high in the dictation test, and still lower in the composition test, but in all three he was among the upper 25 per cent. of the class. Individual 7, however, stood at the top of the class in the composition test, a little above the median in the list test, and in the lowest 25 per cent. in the dictation test.

The curves show that about 75 per cent. of the individuals maintain the same relative position in the class distributions for the list and dictation tests that they do in the composition test (within one unit of variability). The figure shows also that the correspondence between the list and dictation test is closer than between these two formal spelling tests and the spelling in the composition test. Eighty eight per cent. of the individuals maintain the same relative position in the list and dictation tests within one unit of variability.

previous table are reversed. It is the list test that corresponds more closely with the scores for slips in the spellings, while the dictation test corresponds more closely with the total number of errors made. As before, the correspondence between the list and dictation scores is greater than that for any other relation. If the limit of variation is reduced to half the median deviation, the magnitude of the correspondence of course decreases, but the general relations are not greatly changed.

The fact that a child misses certain words in the formal spelling test is not an indication that he will

misspell them in his compositions if he uses them. On the other hand, a child who misses words in either the list or dictation test is quite often the child who makes many slips in writing a composition and has many words improperly spelled. An attempt was made to check these conclusions by direct evidence from the three spelling tests. It was hoped that many of the words used in the formal tests would also be used spontaneously by the children in the composition test. Careful search, however, brought to light but five words which were so used (Table XXXII, page 139); therefore the results are too few to warrant any conclusions except the two previously stated, namely: (1) that measurement of spelling ability is a much more difficult thing than it is popularly supposed to be, and (2) that children, as a rule, use in compositions only those words which they know how to spell.

#### RELIABILITY OF CLASS RESULTS

The preceding discussions have had for their purpose the full statement in regard to the unreliability of the performance of an individual in a single test as a measure of his general ability in spelling. Teachers and principals unfamiliar with testing work are often amazed to see a child whom they have been accustomed to rate as their best speller make a low score in the formal test, while a child who has repeatedly failed in all school work in spelling makes a high score in the same test. Their amazement, due to the apparent contradiction between the test results and their judgments, has in many instances led

TABLE XXXI

RELATION BETWEEN RESULTS OF DIFFERENT SPELLING TESTS<sup>1</sup>

|                        | CLASS<br>AVERAGE | MEDIAN<br>INDIVIDUAL<br>DEVIATION<br>FROM AVERAGE | TOTAL RANGE<br>OF SCORE |
|------------------------|------------------|---------------------------------------------------|-------------------------|
| S = Slips.....         | 19               | 9                                                 | 0— 55                   |
| M = Misspellings. .... | 31               | 16                                                | 0—102                   |
| T = Total Errors.....  | 50               | 16                                                | 0—157                   |
| L = List Test.....     | 55               | 20                                                | 20— 85                  |
| D = Dictation Test...  | 61               | 14                                                | 20— 90                  |

<sup>1</sup>Based on scores of 23 fourth grade pupils, Class No. 11, Emerson.

## COEFFICIENTS OF CORRESPONDENCE

Percentage of Total Cases Which Do Not Vary in Relative Position  
More Than One (or one half) Unit of Variability.

| WITHIN 1 UNIT |    |    |    |    |    | WITHIN $\frac{1}{2}$ UNIT |    |    |    |    |    |
|---------------|----|----|----|----|----|---------------------------|----|----|----|----|----|
|               | S  | M  | T  | L  | D  |                           | S  | M  | T  | L  | D  |
| S             | —  | 52 | 53 | 48 | 39 | S                         | —  | 35 | 35 | 22 | 26 |
| M             | 52 | —  | 61 | 48 | 30 | M                         | 35 | —  | 35 | 22 | 4  |
| T             | 53 | 61 | —  | 26 | 43 | T                         | 35 | 35 | —  | 9  | 30 |
| L             | 48 | 48 | 26 | —  | 61 | L                         | 22 | 22 | 9  | —  | 40 |
| D             | 39 | 30 | 43 | 61 | —  | D                         | 26 | 4  | 30 | 40 | —  |

This table is to be read as follows: If the relation of the scores of the individual children in number of slips made in their compositions, to the median number made by the class as a whole, be compared with the relation of the same individual scores in misspellings to the median number of misspellings made by the class as a whole, 52 per cent. of the children will be found to have maintained the same relative position in the two sets of scores within one unit of variability; that is, within nine slips, or sixteen misspellings.

TABLE XXXII  
SPELLING OF CERTAIN WORDS FOUND BOTH IN SPELLING TESTS AND IN COMPOSITIONS

| WORD         | NUMBER OF EIGHTH GRADE CHILDREN |                                               |                                                 |                                                 |                                                 |
|--------------|---------------------------------|-----------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
|              | USING WORD                      | MISSPELLING WORD IN BOTH TEST AND COMPOSITION | MISSPELLING WORD IN TEST BUT NOT IN COMPOSITION | MISSPELLING WORD IN COMPOSITION BUT NOT IN TEST | SPELLING WORD CORRECTLY IN TEST AND COMPOSITION |
| Minute.....  | 17                              | 2                                             | 2                                               | 0                                               | 18                                              |
| Piece.....   | 6                               | 0                                             | 2                                               | 1                                               | 8                                               |
| Suggested... | 1                               | 0                                             | 0                                               | 1                                               | 0                                               |
| Arrangement. | 1                               | 1                                             | 0                                               | 0                                               | 0                                               |
| Pleasant.... | 2                               | 0                                             | 0                                               | 0                                               | 2                                               |
| TOTAL.....   | 27                              | 3                                             | 4                                               | 2                                               | 18                                              |

This table is to be read as follows: 17 eighth grade children used the word "minute" (which appeared in one of the formal spelling tests) in their compositions. Two children misspelled the word in both the tests and compositions, 2 misspelled the word in the tests and not in the compositions, no one misspelled the word in the compositions who spelled it correctly in the tests, 13 out of 17 children spelled the word correctly in both tests and in the compositions.

In general the table shows that only 6 out of 27 children were uncertain in their performances. Three children misspelled words in both tests and compositions and 18 spelled the words correctly in both tests and compositions; that is, children used in their compositions only words which they knew how to spell.

TABLE XXXIII  
CLASS DEVIATIONS FROM CITY WIDE MEDIAN SCORES IN THE SPELLING TEST

| CLASS<br>NUMBER | NUMBER IN<br>GRAPH | GRADE | DEVIATION FROM MEDIAN |                 | TOTAL MARKING<br>COMBINATIONS |
|-----------------|--------------------|-------|-----------------------|-----------------|-------------------------------|
|                 |                    |       | LIST TEST             | DICTIONARY TEST |                               |
| 14              | 1                  | 2C    | -12.5                 | +2.5            | -2.5                          |
| 15              | 2                  | 2B    | +18.5                 | +16.5           | +14.5                         |
| 18              | 3                  | 2A    | +5.5                  | +7.5            | +17.5                         |
| 23              | 4                  | 3C    | -5.5                  | +7.0            | +4.5                          |
| 16              | 5                  | 3C    | -20.0                 | -12.5           | -22.0                         |
| 17              | 6                  | 3B    | -8.4                  | +1.0            | -32.0                         |
| 20              | 7                  | 3B    | +1.5                  | +9.5            | -32.0                         |
| 19              | 8                  | 3A    | +11.0                 | +7.5            | +6.0                          |
| 21              | 9                  | 3A    | +12.7                 | +12.0           | +1.0                          |
| 32              | 10                 | 4C    | -28.0                 | -14.4           | -39.0                         |
| 22              | 11                 | 4C    | -11.0                 | -5.5            | -19.0                         |
| 24              | 12                 | 4B    | +3.0                  | +7.0            | -39.0                         |
| 28              | 13                 | 4A    | +1.5                  | +2.5            | +1.0                          |
| 29              | 14                 | 5C    | -1.8                  | -10.8           | +19.0                         |
| 30              | 15                 | 5C    | -20.5                 | -28.0           | -39.0                         |
| 31              | 16                 | 5B    | -6.0                  | -2.5            | -39.0                         |
| 37              | 17                 | 5A    | -6.7                  | -5.4            | +1.0                          |
| 33              | 18                 | 6C    | -15.5                 | -8.5            | -39.0                         |
| 38              | 19                 | 6B    | -9.5                  | -8.5            | -39.0                         |
| 39              | 20                 | 6B    | -7.5                  | -8.5            | +1.0                          |
| 40              | 21                 | 6B    | +8.0                  | +6.0            | +19.0                         |
| 41              | 22                 | 6B    |                       |                 |                               |

# SPELLING

141

|    |    |    |       |       |       |
|----|----|----|-------|-------|-------|
| 42 | 23 | 6A | + 6.5 | -12.8 | -15.0 |
| 43 | 24 | 7A | - 1.5 | - 9.5 | -20.0 |
| 44 | 25 | 7A | - 4.5 | -15.5 | + 1.7 |
| 45 | 26 | 8A | - 7.0 | - 4.5 | 0     |
| 46 | 27 | 8A | - 5.5 | - 4.0 | - 5.0 |
|    |    |    |       |       |       |
|    | 28 | 9  | + 1.5 | - 3   | - 1.0 |
|    | 29 | 10 | + .5  | - 5.5 | - 2.0 |
|    | 30 | 11 | + 2.0 | + .5  | - 7.0 |
|    | 31 | 12 | + 3.5 | - 4.5 | - 2.5 |

<sup>1</sup>Based on 31 Froebel classes.

<sup>2</sup>A minus deviation indicates a larger number of mistakes.

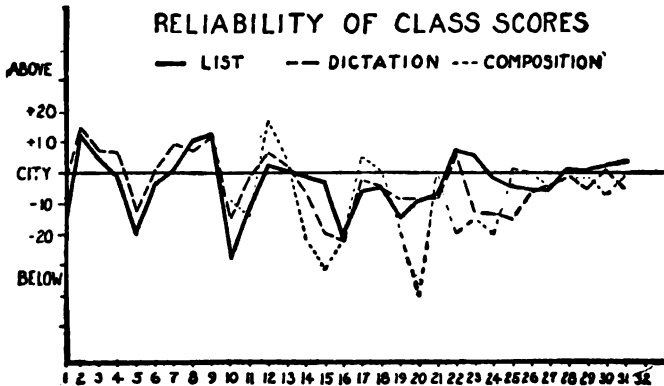
This table is to be read as follows: Class No. 32 Froebel, 5C grade, had a score in the list test of 28.0 per cent. below the average 4C score for the city. In the dictation test it was 14.4 per cent. below, and in the composition test it had 8.6 more errors per hundred words written than the average for the city.



to the conclusion that because the tests are unreliable measures in the cases of a few individuals they are unreliable measures of the class as a whole. Nothing could be further from the truth. The factors which produce variation in the spelling performances of individual children probably in the whole cancel each other within one group, so that if the child of greatest spelling ability who ought to make the highest score in the test happens, on that particular day because of a severe headache or other disturbing factor, to make a low score, his place is taken by some other individual whose ability is relatively lower but who, under the stimulus of the special occasion and the peculiar conditions, makes a score much above that which represents his median performance. As a result, the scores of classes tested with due regard for the control of testing conditions are very reliable, and the results of surveys, such as the present, may be depended upon to reflect the true conditions.

The extent to which these statements are true is shown by the relative standing of the 31 classes in the Froebel school in the three spelling tests (Table XXXIII, page 140, Figure 23, page 143). As the three tests have very different scores, so that direct comparison of score with score is not possible, the expedient has been adopted of referring each class score to the corresponding city wide general value. The generalized city scores express the general development of ability throughout the Gary system. The difference between each class score and this general value shows the class standing. That is, a class that is

FIGURE 23  
CLASS SCORES IN THE LIST, DICTATION, AND COMPOSITION  
SPELLING TESTS



The scale along the base of the figure represents various classes from the second to the twelfth grade in the Froebel school. The scale along the vertical axis represents differences above and below the city wide generalized score.

The solid line is based upon results from the list test; the broken line from the dictation test, the dotted line from the composition test.

Class No. 13 in all three tests made exactly the score chosen to represent the city wide score for the grade. Class No. 20, however, made a score approximately 10 per cent. below the median in both list and dictation tests, but was very very low in the composition test.

As a whole, the curves show that, with a few exceptions, the relative spelling ability of a class is correctly indicated by any one of the three tests.

good in a certain test will have a score much above the city test; a class that is poor in a certain ability will have a score much below the city test. The magnitudes of these differences are, of course, not comparable; for the tests measure spelling under such a variety of conditions that no single basis could be found for the reduction of differences to comparable units. The results show plainly, however, the general standing of any one class in each of the three tests.

The correspondence between the list and dictation tests is close in spite of the fact that the differences in scores given in the table are gross differences, affected by all those factors of variation in attendance, etc., discussed in Chapter VIII. Classes numbered 15 and 20 in the graph show the only marked disagreements. The general correspondence of the differences of the composition tests with the other two sets is also evident, although for several classes the disagreement is marked. This is particularly true of the seventh and eighth grades. Class No. 20, which shows the largest divergence, has been carefully checked on the basis of the scores of children who were present for three trials. The class scores were not materially altered by the differences in attendance. On the other hand, the relative position of the children within the class was closely the same in the three tests. The coefficient of correspondence for the list and dictation tests was 90 per cent.; for the list and composition tests, 80 per cent.; for the dictation and composition tests, 70 per cent. In other words, although this par-

ticular class made a larger number of spelling errors in their compositions than their standing in the list and dictation tests would warrant, the effect is due to some peculiarity of their training, either in composition or spelling, and not to lack of correspondence between the spelling tests themselves. From the results as a whole, it is possible to say that, with one or two exceptions, a class which is shown to be high by any one of the spelling tests will be correspondingly high in each of the other two, and vice versa.

#### CONCLUSIONS

As the conclusions of this survey in regard to the spelling ability of the Gary children have been reached only after a careful study of the full data from three spelling tests, which differ markedly in character and in the conditions under which they were given, and as the results of the three tests agree in their general implications, it seems to the writer probable that the conclusions would not be changed were the number of test words to be largely increased.

## V. ARITHMETIC

### § 1. GENERAL RESULTS

**A**RITHMETIC still holds, in public estimation, a prominent place as one of the fundamentals of both a liberal and a vocational education. In the elementary grades of Gary it is allowed annually 958 hours of classroom time as compared with 1008 hours in the conventional school. Relatively, both allotments are the same, being 19 per cent. of the total time devoted to the fundamentals.

#### PRODUCTS MEASURED

The products of training in arithmetic are many and of varying complexity. They range from such simple skills as addition and multiplication, to such complex products as ability to reason in certain situations. Measurement of the simple skills is comparatively easy, but just what constitutes a legitimate thinking or reasoning problem at each stage of school progress has not yet been determined. Accordingly, no arithmetical reasoning tests were given at Gary.

The mechanical skills in arithmetic selected for measurement at Gary were addition, subtraction, multiplica-

tion, and division of whole numbers and fractions. These abilities are at least fundamental for all arithmetical work, both in school and in later life.

#### TESTS USED

The actual tests used at Gary were selections from the arithmetic tests in the Cleveland Survey, and the Courtis Standard Research Tests, Series B. The Series B tests were given twice, about five weeks apart, April 25 and May 31.

#### RESULTS FROM SERIES B

Half of the eighth grade children were able to work but 8.3 or less of the addition examples in the Series B tests in 8 minutes and at this rate the median accuracy of work was 55 per cent. In subtraction the median eighth grade score rose to 9.0 examples and 72 per cent. accuracy; in multiplication the eighth grade rate was 8.4 examples, accuracy 67 per cent.; in division the eighth grade median was 6.7 examples, the accuracy 74 per cent. (Table XXXIV, page 148). The results for addition are shown graphically in Figure 24, page 150. In all four operations there are small regular increases in both rate of work and in accuracy throughout the elementary grades; a growth that for three operations continues through the high school years as well. In multiplication, however, the development increases very little in accuracy beyond the eighth grade level. In addition and multiplication the twelfth grade accuracy

TABLE XXXIII  
CLASS DEVIATIONS FROM CITY WIDE MEDIAN SCORES IN THE SPELLING TESTS<sup>1</sup>

| CLASS<br>NUMBER | NUMBER IN<br>GRAPH | GRADE | DEVIATION FROM MEDIAN |                |  | TOTAL ERRORS <sup>2</sup><br>COMPOSITIONS |
|-----------------|--------------------|-------|-----------------------|----------------|--|-------------------------------------------|
|                 |                    |       | LIST TEST             | DICTATION TEST |  |                                           |
| 14              | 1                  | 2C    | -12.5                 | + 2.5          |  | - 8.6                                     |
| 15              | 2                  | 2B    | +13.5                 | +14.5          |  | -14.5                                     |
| 18              | 3                  | 2A    | + 5.5                 | + 7.5          |  | +17.5                                     |
| 23              | 4                  | 3C    | - 5.5                 | + 7.0          |  | + 4.5                                     |
| 16              | 5                  | 3C    | -20.0                 | -12.5          |  | -22.0                                     |
| 17              | 6                  | 3B    | - 3.4                 | + 1.0          |  | -32.0                                     |
| 20              | 7                  | 3B    | + 1.5                 | + 9.5          |  | -22.0                                     |
| 19              | 8                  | 3A    | +11.0                 | + 7.5          |  | + 5.0                                     |
| 21              | 9                  | 3A    | +12.7                 | +12.0          |  | + 1.0                                     |
| 32              | 10                 | 4C    | -28.0                 | -14.4          |  | -19.0                                     |
| 22              | 11                 | 4C    | -11.0                 | - 5.5          |  | -39.0                                     |
| 24              | 12                 | 4B    | + 3.0                 | + 7.0          |  | + 1.0                                     |
| 28              | 13                 | 4A    | + 1.5                 | + 2.5          |  | -19.0                                     |
| 29              | 14                 | 5C    | 0                     | - 6.5          |  | + 1.0                                     |
| 30              | 15                 | 5C    | - 1.3                 | -19.8          |  | -39.0                                     |
| 31              | 16                 | 5C    | -20.5                 | -23.0          |  | + 1.0                                     |
| 37              | 17                 | 5B    | - 6.0                 | - 2.5          |  | -19.0                                     |
| 33              | 18                 | 5A    | - 5.7                 | - 5.4          |  | + 1.0                                     |
| 38              | 19                 | 6C    | -15.5                 | - 8.5          |  | -39.0                                     |
| 39              | 20                 | 6B    | - 9.5                 | - 8.5          |  | + 1.0                                     |
| 40              | 21                 | 6B    | - 7.5                 | - 8.5          |  | -19.0                                     |
| 41              | 22                 | 6B    | + 8.0                 | + 6.0          |  | -19.0                                     |

|    |    |    |       |       |       |
|----|----|----|-------|-------|-------|
| 42 | 23 | 6A | + 6.5 | -12.8 | -15.0 |
| 43 | 24 | 7A | - 1.5 | - 9.5 | -20.0 |
| 44 | 25 | 7A | - 4.5 | -15.5 | + 1.7 |
| 45 | 26 | 8A | - 7.0 | - 4.5 | 0     |
| 46 | 27 | 8A | - 5.5 | - 4.0 | - 5.0 |
|    |    |    |       |       |       |
|    | 28 | 9  | + 1.5 | - .3  | - 1.0 |
|    | 29 | 10 | + .5  | - 5.6 | - 2.0 |
|    | 30 | 11 | + 2.0 | + .5  | - 7.0 |
|    | 31 | 12 | + 3.5 | - 4.5 | - 2.5 |

<sup>1</sup>Based on 31 Froebel classes.

\*A minus deviation indicates a larger number of mistakes.

This table is to be read as follows: Class No. 32 Froebel, 5C grade, had a score in the list test of 28.0 per cent. below the average 4C score for the city. In the dictation test it was 14.4 per cent. below, and in the composition test it had 8.6 more errors per hundred words written than the average for the city.



FIGURE 24  
CITY WIDE ACHIEVEMENTS FROM GRADE TO GRADE:

| RATE                                                         |                                                        | RATE                                       |                 |
|--------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------|-----------------|
| NUMBER OF EXAMPLES WORKED BY FOURTH GRADE                    |                                                        | NUMBER OF EXAMPLES WORKED BY EIGHTH GRADE  |                 |
| 927 379 136 486                                              | 927 297 136 486                                        | 927 297 136 486                            | 927 297 136 486 |
| 379 925 340 765                                              | 379 925 340 765                                        | 379 925 340 765                            | 379 925 340 765 |
| 756 478 988 524                                              | 756 478 988 524                                        | 756 478 988 524                            | 756 478 988 524 |
| 837 983 386 140                                              | 837 983 386 140                                        | 837 983 386 140                            | 837 983 386 140 |
| 924 315 353 812                                              | 924 315 353 812                                        | 924 315 353 812                            | 924 315 353 812 |
| 110 861 904 466                                              | 110 861 904 466                                        | 110 861 904 466                            | 110 861 904 466 |
| 854 794 547 355                                              | 854 794 547 355                                        | 854 794 547 355                            | 854 794 547 355 |
| 965 177 192 894                                              | 965 177 192 894                                        | 965 177 192 894                            | 965 177 192 894 |
| 344 124 439 567                                              | 344 124 439 567                                        | 344 124 439 567                            | 344 124 439 567 |
| Accuracy 36 per cent., or about one in three were right.     | Accuracy 55 per cent., or about one in two were right. |                                            |                 |
| RATE                                                         |                                                        | RATE                                       |                 |
| NUMBER OF EXAMPLES WORKED BY TWELFTH GRADE                   |                                                        | NUMBER OF EXAMPLES WORKED BY TWELFTH GRADE |                 |
| 927 297 136 486                                              | 927 297 136 486                                        | 927 297 136 486                            | 927 297 136 486 |
| 379 925 340 765                                              | 379 925 340 765                                        | 379 925 340 765                            | 379 925 340 765 |
| 756 478 988 524                                              | 756 478 988 524                                        | 756 478 988 524                            | 756 478 988 524 |
| 837 983 386 140                                              | 837 983 386 140                                        | 837 983 386 140                            | 837 983 386 140 |
| 924 315 353 812                                              | 924 315 353 812                                        | 924 315 353 812                            | 924 315 353 812 |
| 110 861 904 466                                              | 110 861 904 466                                        | 110 861 904 466                            | 110 861 904 466 |
| 854 794 547 355                                              | 854 794 547 355                                        | 854 794 547 355                            | 854 794 547 355 |
| 965 177 192 894                                              | 965 177 192 894                                        | 965 177 192 894                            | 965 177 192 894 |
| 344 124 439 567                                              | 344 124 439 567                                        | 344 124 439 567                            | 344 124 439 567 |
| Accuracy 68 per cent., or about seven out of ten were right. |                                                        |                                            |                 |

Only the examples not crossed out were correctly worked. Time allowance for all grades, eight minutes.

by successful business men (Table XXXV, page 152). Thus there is evidence that the tests measure skills of value in life and that rates of 12 examples or more, and accuracies of 80 per cent. and higher, are necessary in many forms of commercial activity. The Gary eighth grade product measured by such standards is very low in rate of work, and inadequate in accuracy.<sup>1</sup>

Much more significant are comparisons with the achievements of children in conventional schools. In addition a score of 11.6 examples attempted (Gary 8.4) and accuracy 76 per cent. (Gary 57) may be taken as the average achievement of American schools in northern states (Tables XXXVI and XXXVI-A, pages 153 and 154). These "norms" are derived from tests given in May and June, 1916, in cities of every type, large and small, and in widely separated states. Comparison with scores from large cities (Boston 13.7 examples, accuracy 78 per cent.) would make the Gary results seem correspondingly lower, and with lower scores from the smaller cities, or from rural schools (a county in Pennsylvania, 7.7 examples—52 per cent.) correspondingly higher. Judging from all comparative data available, however, it is quite plain that Gary is low both in rate of work and in accuracy.

The Gary scores in addition, plotted in relation to the median development curve based upon the scores adopted as representing average conditions throughout the

<sup>1</sup>See also Hanus & Gaylord, *Educational Administration and Supervision*, November, 1917.

## THE GARY SCHOOLS

TABLE XXXV<sup>1</sup>  
 SCORES IN SERIES B BY VARIOUS GROUPS OF ADULTS

| OCCUPATION                                                                  | No. of<br>Individuals | Age   | Wages         | ADDITION |      | SUB-<br>TRACTION |      | MULTIPLI-<br>CATION |      | DIVISION |      |
|-----------------------------------------------------------------------------|-----------------------|-------|---------------|----------|------|------------------|------|---------------------|------|----------|------|
|                                                                             |                       |       |               | Rate     | Acy. | Rate             | Acy. | Rate                | Acy. | Rate     | Acy. |
| Columbia School Supply Co.:                                                 |                       |       |               |          |      |                  |      |                     |      |          |      |
| Laborers.....                                                               | 20                    |       | 10-12 cents   | 2.9      | 31   | 2.9              | 31   | 1.7                 | 17   | 1.0      | 40   |
| Laborers.....                                                               | 28                    |       | 12-37 1/2 "   | 6.6      | 61   | 5.0              | 52   | 4.8                 | 42   | 2.7      | 41   |
| Laborers.....                                                               | 20                    |       | 21            | 8.0      | 60   | 5.7              | 67   | 6.0                 | 63   | 3.8      | 71   |
| Low-wage Girls.....                                                         | 5                     | 18-25 | \$400         | 11.4     | 78   | 14.4             | 87   | 10.0                | 68   | 10.2     | 86   |
| Stenographers.....                                                          | 3                     | 18    |               | 12.0     | 75   | 17.3             | 73   | 12.7                | 71   | 14.0     | 88   |
| Housewives.....                                                             | 5                     | 37-46 |               | 12.4     | 79   | 13.0             | 88   | 9.0                 | 76   | 9.2      | 76   |
| Teachers attending George Pea-<br>body School for Teachers<br>(Summer)..... | —                     | 20-45 |               | 12.7     | 75   | 16.2             | 79   | 11.7                | 81   | 14.6     | 95   |
| High-wage Women.....                                                        | 4                     | 21-40 | \$700-\$1,200 | 14.2     | 81   | 23.2             | 78   | 15.5                | 88   | 16.7     | 96   |
| Saleswomen.....                                                             | 12                    | 19-36 |               | 14.5     | 81   | 11.9             | 74   | 10.0                | 64   | 16.1     | 74   |
| Office Employees, Auto. Co. ....                                            | 17                    | 18-32 | \$700-\$1,500 | 18.7     | 86   | 19.2             | 86   | 16.0                | 81   | 16.4     | 96   |
| Miscellaneous.....                                                          | 14                    | 19-44 | \$350-\$1,000 | 16.2     | 83   | 15.4             | 91   | 12.0                | 77   | 9.8      | 88   |
| Iowa Superintendents.....                                                   | 44                    | —     | \$800-\$4,500 | 16.0     | —    | —                | —    | —                   | —    | —        | —    |
| Michigan Supts.....                                                         | 35                    | —     | \$600-\$3,600 | —        | —    | —                | —    | 15.0                | 79   | —        | —    |
| High-wage Men of Independent<br>Means.....                                  | 7                     | —     | —             | 19.1     | 89   | 18.6             | 84   | 12.3                | 87   | 10.3     | 94   |
| City Gas Co. ....                                                           | 28                    | —     | \$300-\$5,000 | 21.0     | 86   | 18.0             | 86   | 16.5                | 79   | 16.0     | 82   |

<sup>1</sup>This table is taken from the Fifteenth Yearbook of the National Society for the Study of Education, part I, page 101, table 3.

This table is to be read as follows: Twenty of the lowest paid laborers in the Columbia School Supply Company's shop, un-  
 skilled men who earn from 10 to 12 cents per hour, when measured with the same tests used at Gary, tried 2.0 examples with an  
 accuracy of 31 per cent. The scores in subtraction were the same. In multiplication 1.7 examples were tried with an accuracy of  
 17 per cent. In division one example was tried with an accuracy of 40 per cent.



## THE GARY SCHOOLS

TABLE XXXVI-A  
COMPARATIVE DATA, SERIES B

| GRADE                 | GARY<br>GENERALIZED<br>SCORES |               | TWENTY CITIES<br>OF INDIANA<br>MAY, 1914 |               | GENERAL<br>TABULATIONS<br>SMALL CITIES<br>JUNE, 1916 |               | SCORES<br>ADOPTED<br>AS NORMS |               | BOSTON<br>MAY, 1915 |               |
|-----------------------|-------------------------------|---------------|------------------------------------------|---------------|------------------------------------------------------|---------------|-------------------------------|---------------|---------------------|---------------|
|                       | RATE                          | ACTU-<br>BACY | RATE                                     | ACTU-<br>BACY | RATE                                                 | ACTU-<br>BACY | RATE                          | ACTU-<br>BACY | RATE                | ACTU-<br>BACY |
| <i>Subtraction</i>    |                               |               |                                          |               |                                                      |               |                               |               |                     |               |
| 4                     | 5.0                           | 41            | —                                        | —             | 7.3                                                  | 76            | 7.4                           | 80            | 7.6                 | 82            |
| 5                     | 5.9                           | 48            | 7.3                                      | 68            | 8.6                                                  | 82            | 9.0                           | 83            | 9.3                 | 85            |
| 6                     | 6.8                           | 55            | 8.9                                      | 73            | 9.7                                                  | 84            | 10.3                          | 85            | 11.1                | 87            |
| 7                     | 8.0                           | 64            | 10.1                                     | 77            | 11.2                                                 | 85            | 11.6                          | 86            | 12.2                | 87            |
| 8                     | 9.0                           | 72            | 11.2                                     | 79            | 12.1                                                 | 85            | 12.9                          | 87            | 13.6                | 89            |
| <i>Multiplication</i> |                               |               |                                          |               |                                                      |               |                               |               |                     |               |
| 4                     | 3.4                           | 37            | —                                        | —             | 6.3                                                  | 68            | 6.2                           | 67            | 6.2                 | 67            |
| 5                     | 4.8                           | 45            | 6.3                                      | 61            | 7.5                                                  | 76            | 7.5                           | 75            | 7.7                 | 76            |
| 6                     | 5.8                           | 52            | 7.6                                      | 67            | 8.8                                                  | 79            | 9.1                           | 78            | 9.4                 | 79            |
| 7                     | 7.2                           | 61            | 8.6                                      | 68            | 10.0                                                 | 80            | 10.2                          | 80            | 10.5                | 81            |
| 8                     | 8.4                           | 67            | 10.2                                     | 71            | 11.0                                                 | 81            | 11.5                          | 81            | 11.6                | 83            |
| <i>Division</i>       |                               |               |                                          |               |                                                      |               |                               |               |                     |               |
| 4                     | 2.4                           | 24            | —                                        | —             | 4.5                                                  | 59            | 4.6                           | 57            | 4.8                 | 65            |
| 5                     | 3.2                           | 34            | 4.5                                      | 57            | 5.7                                                  | 77            | 6.1                           | 77            | 6.5                 | 81            |
| 6                     | 4.1                           | 44            | 5.7                                      | 74            | 7.8                                                  | 87            | 8.2                           | 87            | 8.7                 | 87            |
| 7                     | 5.3                           | 60            | 8.5                                      | 78            | 9.6                                                  | 91            | 9.6                           | 90            | 10.2                | 90            |
| 8                     | 6.7                           | 74            | 10.6                                     | 84            | 10.4                                                 | 93            | 10.7                          | 91            | 12.2                | 92            |

TABLE XXXVI-B

COMPARATIVE DATA, SERIES B

| SCORES OF GARY EIGHTH GRADE CLASSES <sup>1</sup> |                 |           |               |          |               |
|--------------------------------------------------|-----------------|-----------|---------------|----------|---------------|
| SCHOOL                                           | CLASS<br>NUMBER | 1ST TRIAL |               | 2D TRIAL |               |
|                                                  |                 | RATE      | ACCU-<br>RACY | RATE     | ACCU-<br>RACY |
| <i>Addition.</i>                                 |                 |           |               |          |               |
| Froebel . . . . .                                | 45              | 8.7       | 50            | 9.0      | 55            |
| " . . . . .                                      | 46              | 8.0       | 58            | 8.7      | 64            |
| Emerson . . . . .                                | 14              | 8.0       | 50            | 8.0      | 54            |
| " . . . . .                                      | 15              | 7.0       | 53            | 7.2      | 68            |
| Jefferson . . . . .                              | 18              | 10.3      | 64            | 9.5      | 60            |
| <i>Subtraction.</i>                              |                 |           |               |          |               |
| Froebel . . . . .                                | 45              | 9.0       | 75            | 8.5      | 60            |
| " . . . . .                                      | 46              | 9.7       | 67            | 9.6      | 72            |
| Emerson . . . . .                                | 14              | 9.2       | 72            | 9.5      | 64            |
| " . . . . .                                      | 15              | 8.5       | 80            | 8.5      | 68            |
| Jefferson . . . . .                              | 18              | 11.0      | 92            | 10.4     | 81            |
| <i>Multiplication.</i>                           |                 |           |               |          |               |
| Froebel . . . . .                                | 45              | 7.3       | 60            | 8.6      | 71            |
| " . . . . .                                      | 46              | 7.3       | 68            | 9.5      | 82            |
| Emerson . . . . .                                | 14              | 8.2       | 71            | 8.7      | 71            |
| " . . . . .                                      | 15              | 7.0       | 66            | 7.2      | 68            |
| Jefferson . . . . .                              | 18              | 9.7       | 71            | 9.7      | 78            |
| <i>Division.</i>                                 |                 |           |               |          |               |
| Froebel . . . . .                                | 45              | 7.7       | 70            | 7.5      | 85            |
| " . . . . .                                      | 46              | 8.2       | 83            | 7.4      | 80            |
| Emerson . . . . .                                | 14              | 5.3       | 57            | 6.6      | 88            |
| " . . . . .                                      | 15              | 5.2       | 78            | 6.2      | 75            |
| Jefferson . . . . .                              | 18              | 9.2       | 81            | 10.0     | 95            |

<sup>1</sup>See page 194.

United States, make evident both a difference in the general character of the development at Gary, and the fact that the scores made by the Gary children are relatively very low. The Gary curve is concave; the curve from the general results convex (Figure 25, page 157). This difference probably means that in the conventional schools

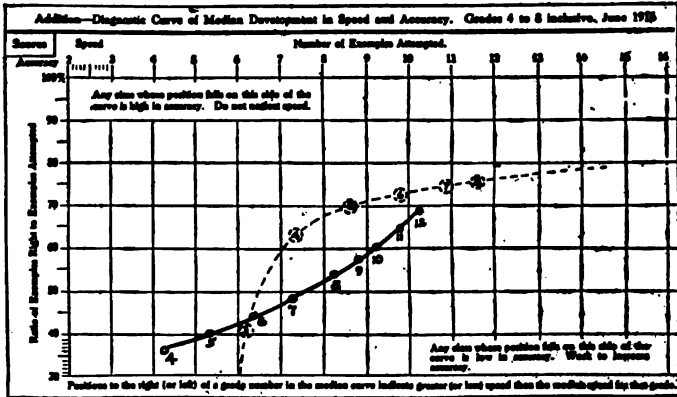
most of the children have learned to add by the end of the fourth grade, and in the remaining grades there are small improvements in both rate and accuracy of work, due partly to increasing maturity, partly to elimination of the less able through non-promotion, dropping out of school, etc., and partly to the effects of training upon those who have not learned in previous grades. In Gary, however, progress in the lower grades is quite uniform in both rate and accuracy, being mainly in rate in the lower grades, and evenly balanced between rate and accuracy in the high school years. The level of work is, however, very low—so low that one is led to wonder how much of the progress is due to training, and how much merely due to the effects of maturity and elimination.<sup>1</sup> For example, the twelfth grade scores in both rate and accuracy do not reach those of the seventh grade in the conventional school, and the eighth grade score at Gary is only slightly above the normal fourth grade level in rate and far below it in accuracy.

The median development curve in Figure 25 is based upon results from cities of every type, large and small, and it is hardly fair to compare the Gary results with those from larger cities which are known to do better in the fundamental subjects than small villages and towns. However, a comparison of the Gary scores with those from smaller cities does not alter the general character of the conclusions to be drawn (Figure 26, page 159).

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<sup>1</sup>See Chapter VIII, page 357.

FIGURE 25  
DEVELOPMENT OF RATE AND ACCURACY IN ADDITION<sup>1</sup>



The scale along the top of the figure represents rate, or the number of examples attempted. The scale along the left hand side of the figure represents ratio of examples right to examples attempted, or the accuracy or work expressed in per cent. Each point of the diagram, therefore, represents two scores—rate and accuracy. The position of the circle marked "4" on the general curve (broken line) represents a rate of 7.4 examples attempted and 64 per cent. accuracy.

The curve for the Gary results is shown by the heavy line. The circles show the position of the different grade scores.

The twelfth grade score in rate falls between the sixth and seventh grade score on the general curve, and slightly below the fifth grade accuracy. The eighth grade Gary results are not quite equal to the general fifth grade scores in rate, and very much lower than the fourth grade accuracy.

The portion of the general curve below the fourth grade is not very reliable, but the difference between the general character of the Gary

<sup>1</sup>Based on results at Gary and results from thousands of children in cities of many different types.



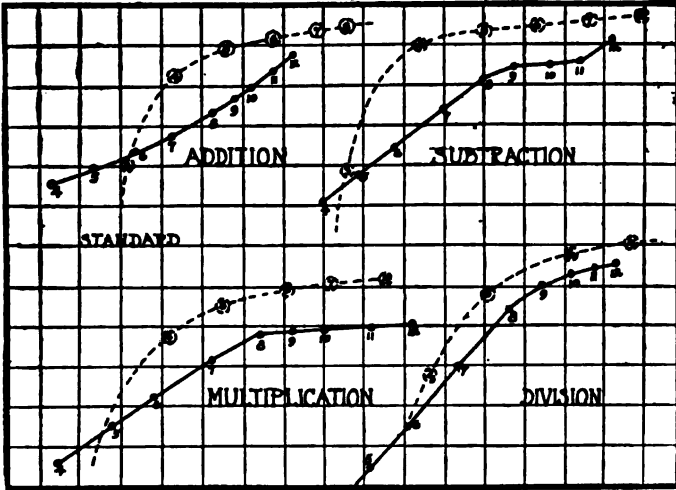
FIGURE 25—*Continued*

curve and that of the general curve is marked. The general curve indicates that the development of skill in addition is, in the conventional school, nearly completed by the end of grade five, while the Gary curve shows that there is a very small, but regular, increase in rate and accuracy from grade to grade up to the end of the high school years. In high school years there is no direct training for the development of skill in addition, so the progress from grade to grade must represent either incidental training, or the effect of the elimination of the less able by non-promotion. Therefore, the Gary curve as a whole would seem to indicate that growth in skill in addition in all grades is due mainly to the same causes, and very little to direct training.

All the Gary curves fall much below those of conventional schools. For all operations the twelfth grade scores in accuracy at Gary do not attain to the conventional levels of the eighth grade accuracy, and for all except multiplication the rate of work is also lower. The eighth grade results in rate are about equal to those of the conventional fifth grade, and in accuracy are lower. In division only do the eighth grade scores in accuracy much exceed those of the fourth grade in the conventional school.

It is possible to find schools with lower records than those at Gary, but they are not common. For instance, in a bulletin issued by the University of Iowa, the scores made by the various Iowa schools in the same tests used at Gary are grouped according to the size of the town from which they came. The towns vary in size from those of less than one thousand population to more than ten thousand population, the class in which Gary would fall. Out of 848 comparisons of scores from towns

FIGURE 26  
DEVELOPMENT OF RATE AND ACCURACY IN FOUR OPERATIONS<sup>1</sup>  
DEVELOPMENT CURVES ARITHMETIC SERIES 3



The curves are drawn in precisely the same fashion as in Figure 25, but all scales have been omitted in order to bring the four curves together in one figure. The reader need only remember that displacement to the right means greater rate, and displacement toward the top of the diagram means greater accuracy. All circles represent scores in both rate and accuracy. The grades are indicated by the small figures near the circles. The solid line represents Gary scores. The broken line represents results from small cities.

The reader should note that in all tests the eighth grade scores are low in both rate and accuracy. Except for multiplication the rate records of the twelfth grade never exceed those of the eighth grade in the conventional school, and in no case do twelfth grade accuracies attain to the level of accuracy of the eighth grade in conventional schools.

<sup>1</sup>Based on Gary results and on results of tests given in smaller cities, May and June, 1916.

and villages of 1000 population or under, but 82 reported scores as low as or lower than Gary. This was approximately 10 per cent. of the total scores. For the next larger size city, the proportion was but 7 per cent., and for the cities of more than 10,000 population, about one half of 1 per cent. How much allowance is to be made for possible differences in the care with which the tests were given and scored is not known, but the instructions for giving the tests are well standardized, the procedure simple and the results consistent. It would seem, therefore, that beyond question the Gary results are exceptionally low.<sup>1</sup>

#### CLEVELAND ARITHMETIC TESTS<sup>2</sup>

Results from the Cleveland Arithmetic Tests will now be considered. The Cleveland tests, it will be remembered, are diagnostic tests. That is, they are graded in difficulty for any one operation, so that by making comparisons on the basis of several tests at once it is possible to judge the effects produced by teaching effort. The portions of the Cleveland Tests used at Gary were those dealing with multiplication and fractions. The results will be discussed separately.

The Gary scores in these tests confirm the conclusions from the comparative data previously shown. The Gary eighth grade scores are but 70 per cent. of the corre-

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<sup>1</sup>Out of 160 comparisons of Gary eighth grade scores with corresponding scores of 20 cities in Indiana, in but 12 cases were their scores as low as or lower than the Gary scores.

<sup>2</sup>See page 39.

sponding Cleveland scores in the simplest test, 82 per cent. in the more complex test, and 87 per cent. in the most difficult multiplication test (Table XXXVII). That the Gary scores are relatively lower in the simple tests than in the complex tests is favorable to the Gary training, as it means that the Gary children use their knowledge of the tables more efficiently than the Cleveland children, but this favorable aspect of the results should not lead the reader to forget that in all grades and tests the Gary scores are much below those of Cleveland.<sup>1</sup>

The curves for the development of the different abilities at Gary are concave, while the Cleveland scores are convex (Figure 27, page 163). This probably means that the development of ability begins, on the average, two or three years later in Gary than in Cleveland, so that the Cleveland curves approach their maxima before the Gary curves start to rise. The Gary results reach the Cleveland eighth grade levels only in the late high school grades.

The significant facts of the comparison between Cleveland and Gary scores are much more readily comprehended if the comparison is put in the form of Figure 28, page 164. One can see at a glance that the progress at Cleveland between grades three and four is more than that made in grades four, five, or six, in Gary. Similarly, the progress in grades four and five in Cleveland is roughly equal to that in grades seven and eight in Gary.

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<sup>1</sup>Comparison with similar data from the Grand Rapids Survey proves that the Gary scores are also much lower than those from that city.

TABLE XXXVII  
CITY WIDE MEDIAN SCORES—CLEVELAND ARITHMETIC TESTS

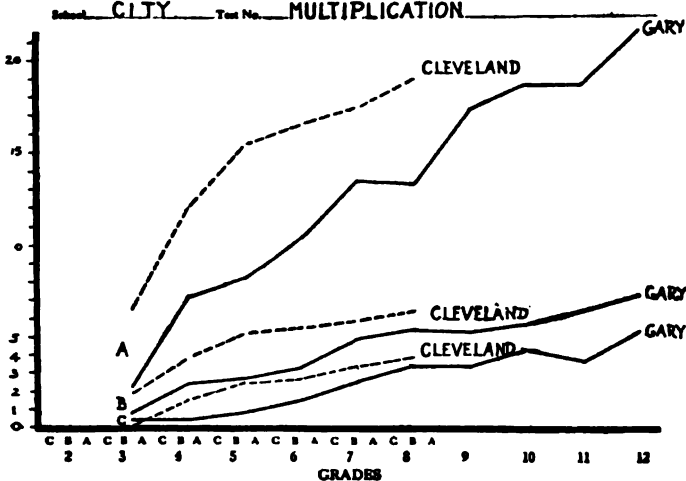
| GRADE | MULTIPLICATION TABLES <sup>1</sup> |           | PER CENT. GARY IS OF CLEVELAND LAND | ONE PLACE MULTIPLICATION |           | PER CENT. GARY IS OF CLEVELAND LAND | TWO PLACE MULTIPLICATION |           | PER CENT. GARY IS OF CLEVELAND LAND |
|-------|------------------------------------|-----------|-------------------------------------|--------------------------|-----------|-------------------------------------|--------------------------|-----------|-------------------------------------|
|       | GARY                               | CLEVELAND |                                     | GARY                     | CLEVELAND |                                     | GARY                     | CLEVELAND |                                     |
|       |                                    |           |                                     |                          |           |                                     |                          |           |                                     |
| 3     | 2.2                                | 6.5       | 34                                  | .9                       | 2.0       | 45                                  | .5                       | —         | —                                   |
| 4     | 7.1                                | 12.0      | 59                                  | 2.8                      | 3.9       | 59                                  | .7                       | 1.7       | 41                                  |
| 5     | 8.2                                | 15.5      | 53                                  | 2.7                      | 5.2       | 52                                  | .9                       | 2.5       | 36                                  |
| 6     | 10.4                               | 16.6      | 63                                  | 3.3                      | 5.5       | 60                                  | 1.5                      | 2.8       | 54                                  |
| 7     | 13.5                               | 17.7      | 76                                  | 4.9                      | 5.9       | 83                                  | 2.6                      | 3.2       | 81                                  |
| 8     | 13.3                               | 19.0      | 70                                  | 5.4                      | 6.6       | 82                                  | 3.4                      | 3.9       | 87                                  |
| 9     | 17.3                               | —         | 91*                                 | 5.3                      | —         | 80*                                 | 3.4                      | —         | 87*                                 |
| 10    | 18.7                               | —         | 98*                                 | 5.7                      | —         | 86*                                 | 4.1                      | —         | 106*                                |
| 11    | 18.7                               | —         | 98*                                 | 6.4                      | —         | 97*                                 | 3.7                      | —         | 98*                                 |
| 12    | 21.5                               | —         | 113*                                | 7.2                      | —         | 109*                                | 5.2                      | —         | 133*                                |

<sup>1</sup>Tabulated on basis of the number of examples correctly worked.

\*Compared with Cleveland eighth grade score.

This table is to be read as follows: The third grade score at Gary in the test of multiplication tables was 2.2 answers right in the time allotted. At Cleveland the score was 6.5 answers right. The Gary result is, therefore, 34 per cent. of the Cleveland result. In the test of the one place multiplication the Gary score was .9 of an example right, and the Cleveland score 2.0. The Gary score was 45 per cent. of the Cleveland score. In the test of the two place multiplication the Gary score was .5 of an example right and the Cleveland score was zero. It is probable, however, that both scores should be zero and that the difference between these two scores and those in succeeding tables is due to a difference in the method of computing the median when more than half of the class have zero scores.

FIGURE 27  
COMPARATIVE SCORES—MULTIPLICATION TESTS  
THE GARY SURVEY  
MULTIPLICATION



The solid lines represent Gary; the broken lines, Cleveland. "A" represents results from the test of multiplication tables. "B" represents a test of one place multiplication. "C" represents two place multiplication. For types of examples see text.

The scale along the base of the figure represents grades. The scale at the left of the figure represents number of examples correctly worked.

Gary curves are concave; Cleveland curves are convex, indicating that development of these abilities takes place at Gary two or three years later than at Cleveland.

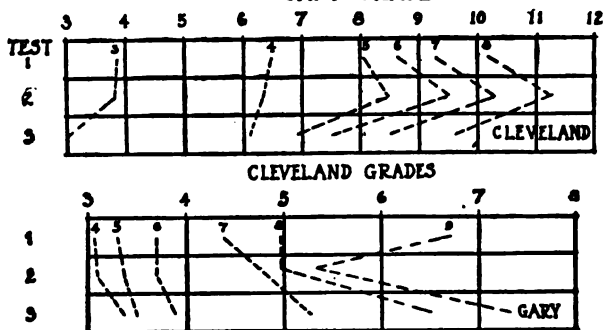
The Cleveland results are expressed in number of examples worked correctly in a given time. As explained elsewhere,<sup>1</sup> the author considers that such records express but a very small part of the meaning of the re-

<sup>1</sup>See page 208.

## THE GARY SCHOOLS

FIGURE 28

RATES OF DEVELOPMENT IN MULTIPLICATION TESTS  
 COMPARISON- CLEVELAND - GARY MULTIPLICATION  
 GARY GRADES



In the diagrams the vertical lines represent the median grade scores; the horizontal spaces represent the multiplication tests.

In the upper diagram the vertical lines are based upon the grade scores at Gary. In the lower diagram the vertical lines are based upon the grade scores in Cleveland. In the upper diagram the dotted lines are drawn in the proper relative position to represent the scores at Cleveland, while in the lower figure it is the Gary scores that are represented by the dotted lines.

From either the upper or lower figure it will be seen that grades four, five, and six at Gary fall between the third and fourth grade curves for Cleveland.

sults; that for a complete understanding of the significance of the data they must be expressed in terms of rate and accuracy of work. Accordingly, the results of the Cleveland Tests have been thus tabulated, and to make the data from different tests easily comparable (that they might be shown in one graph) each rate score

has also been expressed as a percentage of the score made by the twelfth grade (Table XXXVIII, page 166).

The results in this form show that development in the tables is practically completed by the sixth grade (accuracy 91 per cent.) . The development of the ability to use a one place multiplier, however, increases more slowly, and does not approximate its maximum development until the seventh grade (accuracy 84 per cent.). Development of ability to use a two place multiplier is of still a different character. Increases are fairly regular and equal from grade to grade, up to the eighth grade, but from this point on progress in accuracy ceases and the curve indicates increase in rate only (Figure 29, page 167).

In other words, in the simplest work the development is completed early in school life. The more complex is barely completed by the eighth grade. In the most difficult work of all, the development shows no signs of reaching a maximum, and progress is merely cut off at a low level by high school work in which no training in multiplication is provided. In Figure 29 the dotted line is based upon the Gary results in the Series B tests, and attention is called to the exactness with which two sets (Series B, multiplication test No. 3, and Cleveland long multiplication, set L) confirm each other. The meaning of such comparisons is plain; the more complex the ability, the less well it is taught at Gary as measured by intercomparisons of the results at Gary themselves. The evidence from the Cleveland Tests thus greatly



TABLE XXXVIII  
GENERALIZED SCORES—CLEVELAND ARITHMETIC TESTS

| GRADE | MULTIPLICATION TABLES                                 |     | ONE PLACE MULTIPLIER                                 |     | TWO PLACE MULTIPLIER                                 |     | TWO PLACE MULTIPLIER, SERIES B                        |     | MULTIPLICATION TABLES—RATE SCORES FROM GENERAL TABULATIONS |     |
|-------|-------------------------------------------------------|-----|------------------------------------------------------|-----|------------------------------------------------------|-----|-------------------------------------------------------|-----|------------------------------------------------------------|-----|
|       | Rate <sup>1</sup>                                     |     | Rate                                                 |     | Rate                                                 |     | Rate                                                  |     | Rate                                                       |     |
|       | Ex.                                                   | %   | Ex.                                                  | %   | Ex.                                                  | %   | Ex.                                                   | %   | Ex.                                                        | %   |
| 3     | 4.7                                                   | 21* | 2.1                                                  | 27* | 1.6                                                  | 21* | —                                                     | —   | 8                                                          | 35* |
| 4     | 7.2                                                   | 32  | 2.9                                                  | 37  | 2.2                                                  | 29  | 3.4                                                   | 28* | 12                                                         | 52  |
| 5     | 9.7                                                   | 43  | 3.7                                                  | 47  | 2.8                                                  | 37  | 4.8                                                   | 40  | 15                                                         | 65  |
| 6     | 12.2                                                  | 52  | 4.6                                                  | 58  | 3.5                                                  | 44  | 5.8                                                   | 48  | 18                                                         | 78  |
| 7     | 14.7                                                  | 62  | 5.5                                                  | 70  | 4.2                                                  | 56  | 7.2                                                   | 60  | 20                                                         | 86  |
| 8     | 16.9                                                  | 74  | 6.0                                                  | 76  | 4.8                                                  | 64  | 8.4                                                   | 69  | 23                                                         | 100 |
| 9     | 18.6                                                  | 82  | 6.4                                                  | 81  | 5.3                                                  | 71  | 9.2                                                   | 76  | —                                                          | —   |
| 10    | 20.3                                                  | 88  | 6.9                                                  | 87  | 5.9                                                  | 79  | 10.0                                                  | 82  | —                                                          | —   |
| 11    | 21.5                                                  | 96  | 7.4                                                  | 94  | 6.7                                                  | 89  | 11.1                                                  | 92  | —                                                          | —   |
| 12    | 22.7                                                  | 100 | 7.9                                                  | 100 | 7.5                                                  | 100 | 12.1                                                  | 100 | —                                                          | —   |
|       | *That is, 4.7 = 21% of 22.7, the twelfth grade score. |     | *That is, 2.1 = 27% of 7.9, the twelfth grade score. |     | *That is, 1.6 = 21% of 7.5, the twelfth grade score. |     | *That is, 3.4 = 28% of 12.1, the twelfth grade score. |     | *That is, 8 = 35% of 23, the eighth grade score.           |     |

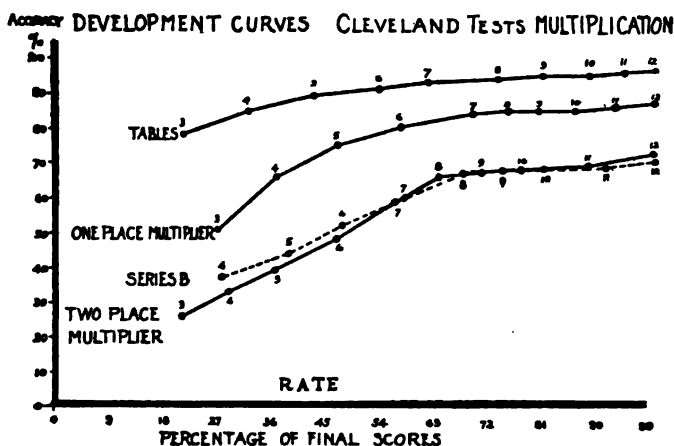
<sup>1</sup>Rate scores are expressed in terms of number of examples attempted and also as percentages of the twelfth grade score in each test.

This table is to be read as follows: In the test of the multiplication tables, the third grade tried 4.7 examples, which was 21 per cent. of 22.7 examples, the twelfth grade score in rate. The accuracy of work was 78 per cent.  
Comparative scores of multiplication tables are taken from Bulletin No. 2, Courtis Standard Research Tests, also based upon tabulations of about 70,000 scores from schools in many cities. The scores as given in the table are half those given in the bulletin because, although the test was the same, the time allowance at Gary was about half that of the tests upon which the scores in the bulletin are based.

The comparative scores for the multiplication tests fully confirm the comparisons previously made between the Gary and Cleveland scores.

The average difference of generalized from actual city wide median scores is as follows: Multiplication: rate .8, accuracy 3.8. One place multiplier: rate .1, accuracy 3.3. Two place multiplier: rate .1, accuracy 2.5.

FIGURE 29  
RATES OF DEVELOPMENT IN THREE MULTIPLICATION TESTS



The scale along the horizontal axis represents the percentage the rate scores of each grade are of the rate scores made by the twelfth grade. The scale along the left of the figure represents accuracy of work. The three solid lines represent the curves for the three multiplication tests which differ in complexity, ranging from a very simple test of the multiplication tables up to long multiplication (four place numbers multiplied by two place numbers.). The dotted line represents the results from the multiplication test in Series B. In all, the circles show the position of the grade scores in both rate and accuracy. The curves differ markedly in their character; that for long multiplication showing no signs of reaching a maximum. The development is merely interrupted at the eighth grade.

As a whole, the set of curves means that the more complex the ability the less well it is taught.

strengthens the conclusions drawn from a comparison of the Gary results with those from other cities.

The clearness with which such diagnostic tests reveal the story of what is taking place within a school system is strikingly illustrated in the case of the fraction tests. Fractions represent, of course, a more complex type of development than multiplication. The examples in the tests called simple fractions were all of the type  $\frac{1}{2} + \frac{1}{2}$  or  $\frac{1}{2} - \frac{1}{2}$ ; in which the only response called for was the addition or subtraction of the numerators. In the test called complex fractions, however, the examples involved reduction to a common denominator and reduction to lowest terms. Further, the complex test included multiplication and division of fractions, as well as addition and subtraction. The examples in the test were of the type  $\frac{1}{2} + \frac{1}{2}$ . Twenty one was the largest denominator called for in any example and all the denominators were products of simple factors.

The character of the development revealed by the results (Table XXXIX, page 169) is a confirmation of the conclusions of the previous discussions. For the test in simple fractions the increases in accuracy from grade to grade are relatively large and continue up to the tenth grade. For complex fractions the period of rapid increase does not begin until grade seven, and from that point is in accuracy only (Figure 30, page 171). In other words, the results for fractions differ from those for multiplication in exactly the same general fashion as the

TABLE XXXIX  
GENERALIZED SCORES FOR FRACTIONS—CLEVELAND ARITHMETIC TESTS

| GRADE | SIMPLE FRACTIONS                                  |     |       | COMPLEX FRACTIONS                                    |     |       | COMPARATIVE SCORES—GARY AND CLEVELAND,<br>BASED UPON NUMBER OF EXAMPLES RIGHT                                                                                                                        |           |                   |           |
|-------|---------------------------------------------------|-----|-------|------------------------------------------------------|-----|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------|-----------|
|       | Rate <sup>1</sup>                                 |     | Acqy. | Rate                                                 |     | Acqy. | Simple Fractions                                                                                                                                                                                     |           | Complex Fractions |           |
|       | Ex.                                               | %   |       | Ex.                                                  | %   |       | Gary                                                                                                                                                                                                 | Cleveland | Gary              | Cleveland |
|       |                                                   |     |       |                                                      |     |       |                                                                                                                                                                                                      |           |                   |           |
| 3     | 6                                                 | 7°  | 28    | 0                                                    | 0   |       | .6°                                                                                                                                                                                                  | 0         | .5°               | 0         |
| 4     | 1.9                                               | 22  | 36    | 1.2                                                  | 14° | 26    | .7°                                                                                                                                                                                                  | 0         | .6°               | 0         |
| 5     | 3.2                                               | 38  | 44    | 5.4                                                  | 64  | 28    | .9°                                                                                                                                                                                                  | 5.0       | 1.0°              | 0         |
| 6     | 4.8                                               | 56  | 51    | 7.6                                                  | 89  | 30    | 2.4                                                                                                                                                                                                  | 5.5       | 2.4               | 3.1       |
| 7     | 5.5                                               | 65  | 55    | 8.4                                                  | 99  | 33    | 3.3                                                                                                                                                                                                  | 7.7       | 3.1               | 4.1       |
| 8     | 6.4                                               | 76  | 63    | 8.5                                                  | 100 | 45    | 2.8                                                                                                                                                                                                  | 8.5       | 3.3               | 5.5       |
| 9     | 7.3                                               | 86  | 74    | 8.5                                                  | 100 | 52    | 4.9                                                                                                                                                                                                  | —         | 3.7               | —         |
| 10    | 8.1                                               | 95  | 84    | 8.5                                                  | 100 | 56    | 7.5                                                                                                                                                                                                  | —         | 4.2               | —         |
| 11    | 8.3                                               | 98  | 85    | 8.5                                                  | 100 | 56    | 5.8                                                                                                                                                                                                  | —         | 3.8               | —         |
| 12    | 8.5                                               | 100 | 85    | 8.5                                                  | 100 | 56    | 6.5                                                                                                                                                                                                  | —         | 3.7               | —         |
|       | *That is 6 is 7% of 8.5, the twelfth grade score. |     |       | *That is 1.2 is 14% of 8.5, the twelfth grade score. |     |       | *Computed results. Probably scores should be made to be comparable with Cleveland. Actually half the class, or more, have zero scores. The method of computing the score at Cleveland is not stated. |           |                   |           |

<sup>1</sup> Rate scores also expressed as percentages of eighth grade scores in each test.

This table is to be read as follows: In the test of simple fractions, the third grade tried .6 of an example, which was 7 per cent. of 8.5 examples, the twelfth grade score in rate. The accuracy of work in the third grade was 28 per cent. In the complex fractions, the third grade were unable to do any of the examples, and in the second part of the table, the third grade score at Gary is given as .6, and in Cleveland as 0. For the complex fractions, the Gary score is .5 and the Cleveland score 0. The Gary scores are computations based upon the distributions. It is not probable that the Gary scores in these grades were higher than Cleveland, but the Cleveland practice is unknown. If the actual median scores were taken the Gary scores would be 0 also.

The accuracies given in the first part of the table were derived from tabulations based upon the individual rate and accuracy. They cannot be compared with accuracies derived from finding what per cent. the median rights are of the median attempts.

The average difference of generalized from actual city wide median scores is—simple fractions—rate: 4; accuracy 2.2; complex fractions rate 4; accuracy 3.4.

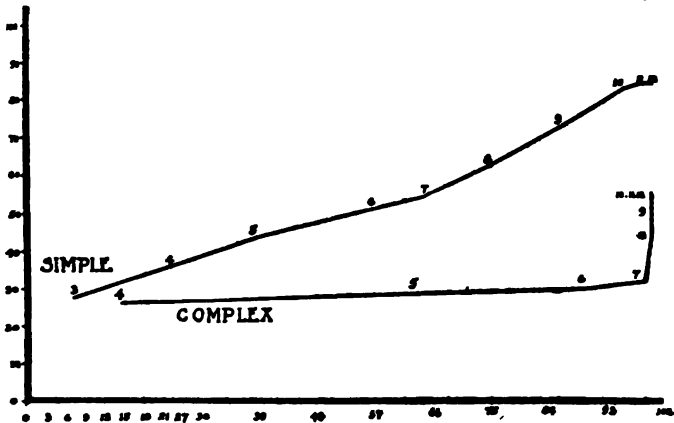
multiplication results differ among themselves. The more complex the ability, the less the development.

#### SCHOOL TO SCHOOL COMPARISONS

A comparison of the scores from school to school reveals rather larger differences in arithmetical abilities than in those discussed in the previous chapters. The school which is least well equipped to carry out a modern program, the Beveridge, shows quite uniformly in all tests a larger number of scores above the city median than the other schools. Jefferson is second, Froebel third, and Emerson fourth (Table XL, page 172). That is, the Emerson school has, proportionately, a larger number of low scores than any other school. In all schools, however, there are individual classes which have scores above the city median, and others which fall below it.

A similar school to school comparison based upon results in the Cleveland tests gave very similar results (Table XLI, page 173, Figure 31, page 174). Nevertheless, the differences from school to school are relatively insignificant and probably mean merely that the Beveridge school gives more emphasis to the drill work. In Emerson, on the other hand, arithmetic is, in general, receiving less attention than in Jefferson and Froebel schools. In all the schools the very best classes have scores much below those made by children of corresponding grades in other cities.

FIGURE 30  
 RATES OF DEVELOPMENT IN TWO FRACTION TESTS  
 DEVELOPMENT CURVES CLEVELAND TESTS-FRACTIONS



The scale along the horizontal axis represents the percentage the rate scores of each grade are of the rate scores made by the twelfth grade. Scale along the left of the figure represents accuracy of work. The two solid lines represent the curves for the two fraction tests; one, the addition or subtraction of fractions having the same denominator, the other, four operations with fractions having unlike denominators. For illustration of the type of examples see text. In both curves the position of the figures indicate grade scores in both rate and accuracy.

The curve for the simple fraction test shows a smaller rate of rise in accuracy than the curves for long multiplication in the previous figure, and for the reasons there explained. The curve for the complex test in fractions indicates mere growth in rate up to the seventh grade, and from that point on, growth in accuracy only.

As a whole, the two curves show that the Gary children have very little ability to work with fractions.

TABLE XI  
SCHOOL TO SCHOOL COMPARISONS—CLEVELAND TESTS

| GRADE | CITY WIDE MEDIAN SCORES |     |     |           |     |  | BEVERIDGE      |     |     |           |     |  | EMERSON        |     |     |           |     |  |
|-------|-------------------------|-----|-----|-----------|-----|--|----------------|-----|-----|-----------|-----|--|----------------|-----|-----|-----------|-----|--|
|       | MULTIPLICATION          |     |     | FRACTIONS |     |  | MULTIPLICATION |     |     | FRACTIONS |     |  | MULTIPLICATION |     |     | FRACTIONS |     |  |
|       | A                       | B   | C   | D         | E   |  | A              | B   | C   | D         | E   |  | A              | B   | C   | D         | E   |  |
|       |                         |     |     |           |     |  |                |     |     |           |     |  |                |     |     |           |     |  |
| 3     | 2.2                     | .9  | .5  | .6        | .5  |  | 1.7            | 1.0 | .6  | .5        | .5  |  | 2.7            | .8  | .5  | .5        | .6  |  |
| 4     | 7.1                     | 2.3 | .7  | .7        | .6  |  | 8.7            | 2.4 | .7  | .5        | .6  |  | 5.0            | 1.5 | .8  | .8        | .7  |  |
| 5     | 8.2                     | 2.7 | .9  | .9        | 1.0 |  | 10.3           | 3.7 | 1.4 | 2.5       | 2.0 |  | 5.7            | 2.1 | .7  | .7        | 1.2 |  |
| 6     | 10.4                    | 3.3 | 1.5 | 2.4       | 2.4 |  | 9.0            | 9.0 | 1.7 | 4.4       | 3.0 |  | 9.3            | 2.7 | .8  | .8        | 1.5 |  |
| 7     | 13.5                    | 4.9 | 2.6 | 3.3       | 3.1 |  | 13.0           | 5.0 | 2.3 | .8*       | 3.0 |  | 12.2           | 3.8 | 1.8 | .9        | 3.0 |  |
| 8     | 13.3                    | 5.4 | 3.4 | 2.8       | 3.3 |  | —              | —   | —   | —         | —   |  | 12.0           | 4.8 | 2.8 | .9        | 3.5 |  |

\*Reason for low score unknown. Scores made by 7A section of same class tested in same room at same time, 4-3.

This table is to be read as follows: In the third grade the actual city wide median score in the test of the multiplication tables is 2.2 examples right, in the test involving one place multiplier, .9 examples, in the test involving two place multiplier, .5; in the test involving simple fractions, .6 examples, and in the test involving complex fractions, 5 examples.

The corresponding scores in the Beveridge school were 1.7 examples, etc., and in the Emerson school, 2.7 examples, etc.

## MEASUREMENT OF REASONING POWER

It may be contended by some that in place of skill in computation the Gary children are receiving a type of training which develops reasoning power instead, and makes them better able to cope with arithmetical situations after they leave school.

The answers to this claim are: First, no evidence of such superior ability to grapple with arithmetical

TABLE XLI

## SCHOOL TO SCHOOL COMPARISON—SERIES B—TWO TRIALS

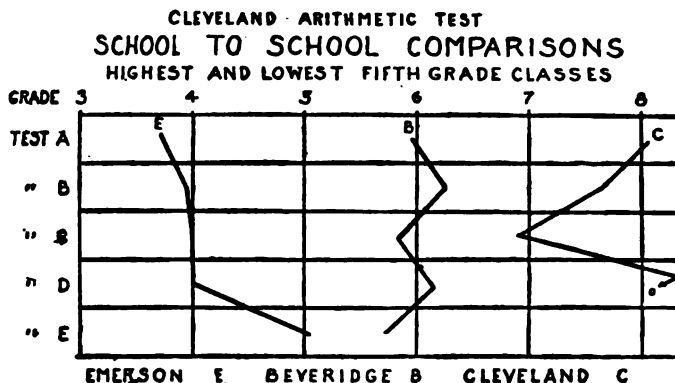
The results below show the number of class scores in each school which are more than one tenth of the corresponding city wide scores above or below the general results for the city as a whole. All four operations are combined.

| SCHOOL          | NUMBER<br>OF<br>CLASS<br>SCORES<br>COMPARED | NUMBER OF CLASS SCORES ABOVE AND<br>BELOW CITY WIDE RESULTS |               |                   |                   |
|-----------------|---------------------------------------------|-------------------------------------------------------------|---------------|-------------------|-------------------|
|                 |                                             | RATE<br>ABOVE                                               | RATE<br>BELOW | ACCURACY<br>ABOVE | ACCURACY<br>BELOW |
| Froebel. ....   | 176                                         | 34                                                          | 27            | 50                | 46                |
| Emerson. ....   | 78                                          | 2                                                           | 27            | 6                 | 17                |
| Jefferson. .... | 104                                         | 37                                                          | 27            | 30                | 26                |
| Beveridge. .... | 96                                          | 37                                                          | 28            | 47                | 13                |

This table is to be read as follows: Out of 176 class scores in Froebel compared with the corresponding city wide scores, there were 34 in rate and 50 in accuracy markedly above the median, and 27 in rate and 46 in accuracy markedly below the median. That is, the Froebel school ranks were slightly above the general results for the city. Similarly, the Jefferson school is slightly higher than the Froebel school, but lower than the Beveridge school, and much above the Emerson school in the abstract work.



FIGURE 31  
SCHOOL TO SCHOOL COMPARISON



Comparison of scores made by fifth grade classes in the Beveridge (highest) and Emerson (lowest) schools in Gary with the city wide medians

The horizontal spaces represent the Cleveland arithmetic tests in multiplication and fractions. The vertical line represents the Gary city wide grade medians. The line marked "E" represents the scores from the Emerson school; line marked "B"—the scores from the Beveridge school; the line marked "C"—Cleveland fifth grade scores.

The fifth grade class in the Beveridge school falls about one year above the average for the fifth grade city wide scores, while the fifth grade in the Emerson school falls about an equal distance below. The curve for the average scores of the fifth grade in Cleveland was represented by the third curve except in the complex test in fractions, in which the Cleveland score is given as zero. The Cleveland fifth grade scores fall between those of the seventh and eighth grades at Gary.

situations was discovered in the course of the survey, although the children were repeatedly required to score their papers, and to perform other work incidental to the testing which required an intelligent use of mathematical skills as a means to an end. Second, however well a person may be able to reason, his work in the world will be ineffective if he does not have the mechanical skill necessary to obtain correct results. In educational circles there are some who claim that a child will develop such skill as need arises, provided he has a motive for doing his work correctly. The reader should be careful to note, however: First, that the scores made by the high school classes show very small increases in ability over those of the eighth grade in spite of the fact that these classes have more or less incidental training in arithmetic through its use in algebra, physics, chemistry, etc.; and, second, that there is no evidence of any beneficial transfer from the incidental use of arithmetic in the shop work and activities of the enriched curriculum.

There should, however, be no confusion in the mind of the reader in regard to this point. The tests used were not given to measure reasoning power.<sup>1</sup> They prove merely that the Gary children do not possess the ability to add, subtract, multiply, and divide at a reasonable rate and with reasonable accuracy—defining reasonable as that rate and accuracy which is attained by the average child in the conventional school.

<sup>1</sup>See Chapter VII, page 328.

## §2. CRITICAL DISCUSSION

## TYPES OF PRODUCTS

Training in arithmetic falls sharply into two divisions, (1) arithmetical computations and (2) reasoning.

The products of the first type of training are mechanical skills or habits. Training involves building up a set of responses to objective stimuli. The stimuli themselves, the controlled associations called forth by them, and motor responses, are the elements out of which such skills are built. The products of training have two fundamental aspects: speed, or, better, rate, the amount of work done per unit of time; and accuracy, or the relation of the work that is correct to the total work done. Both of these are easily measurable in objective units.

The higher thought processes of the second type (reasoning) are much more complex, and the products of school training in them are much less clearly defined. Moreover, as in testing work, all reasoning problems must be represented through printed symbols, the actual results obtained in a reasoning test are merely unanalyzed resultants of reasoning ability and ability in reading. In view of the many uncertainties and difficulties connected with testing such abilities, and interpreting the results, it was decided to limit the measurement of arithmetical products to the fundamental skills.

## TESTS OF SKILLS

For the mechanical skills of arithmetic, well standardized tests and standards and a growing volume of com-

parative data are available for interpretative purposes. The Courtis Standard Research Tests, Series B, measure the end products of training. Certain of the arithmetic tests used at Cleveland, namely, those dealing with the various phases of multiplication and fractions, trace the relative development of these abilities. The tests, as a whole, therefore, show plainly the nature of the development and the character of the product of the classroom teaching of the fundamental skills.

The expression "end product" needs definition and explanation. In multiplication, for example, it is easy to show that the products of training in the various grades differ greatly in complexity. In most school systems the children begin development of skill in multiplication by learning the multiplication tables. At a later grade they master the technique of carrying. Soon after that they are able to multiply a four or five place number by any single digit, and finally they are able to multiply any integral number by any other integer. This is the end of the development in multiplication itself, although further training in the use of this skill is necessary. A test which is designed to measure the most complex form in which a given skill is found is a test of the end product.

The significant points to be noted in the foregoing discussion are two: (1) that some children in every grade above the third complete their development in multiplication as far as their maturity permits; (2) that each type or partial phase of development is in reality a distinct ability. Each of these points will be discussed further.

The type of ability selected to represent the end product is, of course, a mere matter of convention. The convention adopted for the Courtis Tests is that in any operation the units selected shall be the smallest that cover all the essential elements. These elements for the different operations are as follows:

ELEMENTS COVERED BY TYPE OF EXAMPLES USED IN THE ARITHMETIC TESTS (SERIES B)

| ADDITION                    | SUBTRACTION                 | MULTIPLICATION              | DIVISION                     |
|-----------------------------|-----------------------------|-----------------------------|------------------------------|
| 1 Knowledge of Combinations | 1 Knowledge of Combinations | 1 Knowledge of Combinations | 1 Knowledge of Combinations  |
| 2 Bridging the Tens         | 2 Borrowing                 | 2 Place Value               | 2 Place Value                |
| 3 Carrying                  | 3 Fatigue                   | 3 Carrying                  | 3 Estimation of the Quotient |
| 4 Attention Span            |                             | 4 Addition                  | 4 Multiplication             |
| 5 Fatigue                   |                             | 5 Fatigue                   | 5 Subtraction                |
|                             |                             |                             | 6 Fatigue                    |

The smallest types of examples<sup>1</sup> that can be selected to include these elements in their simple form are given below:

| ADDITION        | SUBTRACTION | MULTIPLICATION | DIVISION  |
|-----------------|-------------|----------------|-----------|
| 927 297 136 486 | 107,795,491 | 3,597          | 94)85,352 |
| 379 925 340 765 | 77,197,029  | 73             |           |
| 756 478 988 524 |             |                |           |
| 837 983 386 140 | 75,088,824  | 5,739          | 37)9,990  |
| 924 815 353 812 | 57,406,394  | 85             |           |
| 110 661 904 466 |             |                |           |
| 854 794 547 355 | 160,620,971 | 4,268          | 73)53,765 |
| 965 177 192 834 | 51,274,887  | 37             |           |
| 344 124 439 567 |             |                |           |
|                 | 80,861,887  | 6,428          | 49)81,409 |
|                 | 25,842,708  | 58             |           |

<sup>1</sup>Except in subtraction.

The figures in these examples are not determined by chance, but in accordance with a systematic plan. For instance, in the multiplication examples the reader should notice that in multiplying 3597 by 73 and 4268 by 37 a child is called upon to use every one of the combinations of the three and seven tables except the one and the zero combinations, for 2, 3, 4, 5, 6, 7, 8, and 9 are all represented in the multiplicands. In similar fashion, care is taken to test all combinations and situations throughout the tests, the combinations omitted being only those which appropriate tests have proved are of extreme simplicity. Equal care is taken in all of the tests to cover for each operation every factor mentioned above, and enough material is provided to keep even the brightest child busy for at least four minutes. For in four minutes the average child will reveal any marked tendency to make errors because of a lack of control of those forces which tend to divert attention after a few minutes of continuous activity of a single type, forces commonly described by the word fatigue.

The care taken in the construction of the examples for these tests makes possible the construction of other tests of equal difficulty but differing in every answer. At the time the Gary survey was begun, three such editions were in general use throughout the country. These were known respectively as Forms 1, 2 and 3. Form 3 was used at Gary for the first test, but in order to prevent any possible suggestion that there might have been direct preparation for the tests, a fourth edition, Form 4,

was prepared and used for the first time at Gary. This was done before the tests of Form 3 had been scored.

The tests were given under precisely the same conditions from the fourth to the twelfth grades, inclusive. Even in the fourth grade, children were found who showed by their scores that they possessed to a greater or less degree all the abilities measured by the tests. For instance, the percentages of fourth grade children who equal or excel the eighth grade median score for examples correctly worked are:

|                                                                                   | ADDITION  |           | SUBTRAC-<br>TION |           | MULTIPLI-<br>CATION |           | DIVISION  |           |
|-----------------------------------------------------------------------------------|-----------|-----------|------------------|-----------|---------------------|-----------|-----------|-----------|
|                                                                                   | FORM<br>3 | FORM<br>4 | FORM<br>3        | FORM<br>4 | FORM<br>3           | FORM<br>4 | FORM<br>3 | FORM<br>4 |
| Per cent. of fourth grade children equaling or exceeding eighth grade median..... | 6.7       | 6.3       | 1.5              | 6.0       | 1.0                 | .01       | .05       | .08       |
| Per cent. of fourth grade children getting one or more examples right             | 60        | 60        | 16               | 69        | 49                  | 55        | 17        | 21        |

These figures would make it evident that the tests measure very simple skills, the teaching of which is completed in most schools by the fourth grade, since, at the time the tests were given, from one sixth to two thirds of the children "knew how" to get at least one example right. This means that were these children given time enough, they could complete every example in the test and get every example right. Therefore, as given, the tests measure skill, or ability to do, not mere

knowledge of "how to do." In the lowest fourth grade class (4C) there are none, or very few children, who, at the beginning of the year, can do long division, but by the end of the 4A classes, a knowledge of this process has also been acquired. The tests are, therefore, measures of the end product of teaching effort, and the changes in scores from grade to grade are due to changes in skill, not to changes in knowledge.

Increases in skill from grade to grade are determined by three sets of causes. Part of it is due to increasing maturity of the children as they pass through the grades.<sup>1</sup> Eighth grade children are certain to show a higher rate of work than fourth grade children, simply because they are older and, consequently, have more highly developed nerves and muscles. Part of it is caused by daily use of the four processes in arithmetic in and out of school. A child is under a steady pressure from his teachers and his school work to perfect his skills, and both rate of work and accuracy are benefited. And part of it is caused by teaching effort. If a teacher of the sixth grade discovers that a particular child does not know certain fundamental combinations, or has faulty habits of carrying, or does not know how to control the critical pulses of his attention, she may make such explanations and provide such training that the individual will overcome his peculiar difficulties and rise at once to new levels of ability.

The second point to be noted is that each type of

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<sup>1</sup>See Chapter VIII, page 357.



## THE GARY SCHOOLS

TABLE XLII  
INDIVIDUAL IDIOSYNCRASIES IN RELATED SKILLS

|                                        | SCORE IN TEST A |       | SCORE IN TEST B |       | SCORE IN TEST C |       | RATIO A-B |       | RATIO A-C |       | RATIO B-C |       |
|----------------------------------------|-----------------|-------|-----------------|-------|-----------------|-------|-----------|-------|-----------|-------|-----------|-------|
|                                        | RATE            | ACCT. | RATE            | ACCT. | RATE            | ACCT. | RATE      | ACCT. | RATE      | ACCT. | RATE      | ACCT. |
| Median Scores of class of 42 children: | 14              | 93    | 6               | 86    | 5               | 63    | 2.3       | 1.1   | 2.8       | 1.5   | 1.2       | 1.4   |
| SELECTED INDIVIDUALS                   |                 |       |                 |       |                 |       |           |       |           |       |           |       |
| A                                      | 7               | 100   | 7               | 86    | 6               | 100   | 1.0       | 1.2   | 1.2       | 1.0   | 1.2       | .9    |
| B                                      | 9               | 90    | 6               | 50    | 8               | 67    | 1.5       | 1.8   | 3.0       | 1.3   | 2.0       | .7    |
| C                                      | 12              | 91    | 4               | 67    | 2               | 0     | 3.0       | 1.4   | 6.0       | —     | 2.0       | —     |
| D                                      | 14              | 85    | 5               | 100   | 4               | 75    | 2.8       | .8    | 3.5       | 1.1   | 1.2       | 1.3   |
| E                                      | 14              | 79    | 5               | 80    | 5               | 40    | 2.8       | 1.0   | 2.8       | 2.0   | 1.0       | 2.0   |
| F                                      | 14              | 100   | 6               | 83    | 5               | 80    | 2.3       | 1.2   | 2.8       | 1.2   | 1.2       | 1.0   |
| G                                      | 14              | 100   | 7               | 86    | 5               | 80    | 2.0       | 1.2   | 2.8       | 1.2   | 1.4       | 1.1   |
| H                                      | 16              | 87    | 5               | 100   | 6               | 50    | 3.2       | .9    | 2.7       | 1.7   | .8        | 2.0   |
| I                                      | 17              | 88    | 5               | 100   | 3               | 33    | 3.4       | .9    | 5.7       | 2.7   | 1.7       | 3.0   |
| J                                      | 22              | 100   | 5               | 80    | 4               | 100   | 4.4       | 1.2   | 5.5       | 1.0   | 1.2       | .8    |

This table is to be read as follows: Tests A, B, and C were each composed of multiplication examples of a single type. Test A was a test of the multiplication tables. Test B was a measure of the ability to multiply a four place number by a one place number. Examples in test C called for the multiplication of a four place number by a two place number.

The median score of 42 eighth grade children was 14 answers written per minute in the test of the multiplication tables with an accuracy of 93 per cent.; in test B, 6 examples in one minute with an accuracy of 86 per cent.; in test C, 5 examples in three minutes with an accuracy of 63 per cent. That is, test A in rate was 2.3 times the score of test B, in accuracy 1.1 times. The score of test A was, in rate, 2.8 times the score in test C, in accuracy 1.5 times. The score in test B was, in rate, 1.2 times the score of test C, and in accuracy 1.4 times. These scores and ratios should serve to place the abilities of individual children; thus, individual A tried only one half as many examples as the class average (7) but worked with perfect accuracy. He tried the same number of examples in test B as in test A, with an accuracy equal to that of the class as a whole. In other words, although his score was only one half the class score in the tables, yet in both test B and test C, where the tables are used, he worked more examples than the class and with the same or higher degree of accuracy. Note that individual J, who had the highest score in the simple test, had only an average score in the difficult tests. That is, there is little connection between the scores of an individual in the simple tests and his scores in the complex test.

element that enters into the end product is itself a distinct ability. Inferences from one test to another must be made with extreme caution. The organization of individual minds varies so greatly that one dare not say, before an actual test has been given, that because a child makes a high score in such examples as 3768 multiplied by 74, he will, therefore, make a high score in a test composed of such simple elements as 8 multiplied by 4, 5 multiplied by 7, 3 multiplied by 6.

For instance, the three Cleveland tests used at Gary consisted of examples of the following types.

| A |   | B     | C     |
|---|---|-------|-------|
| 8 | 6 | 3,498 | 3,498 |
| 4 | 7 | 7     | 47    |
| — | — | —     | —     |

Type A involves only knowledge of the combinations. Type B requires also ability to carry, while type C covers all the elements listed previously. While the median eighth grade score in Test A is 14 answers per half minute with an accuracy of 93 per cent., the individual abilities range from 7 answers per half minute with an accuracy of 100 per cent. to 22 answers per half minute with an accuracy of 100 per cent. (Table XLII, page 182). It would seem on first thought that when one of two children has three times the knowledge of the multiplication tables that the other possesses he must have correspondingly greater ability to multiply in long division examples. The results show, however, that it is the child with the least

ability in the tables that makes the highest scores in the complex test. Many evidences of such personal idiosyncrasies will be noted. To what extent chance individual variation is the cause of the apparent discrepancies in the particular results quoted is not known, but from personal experience in teaching such children the writer is ready to vouch for the existence of such conditions.

No valid conclusion may be drawn from a few selected cases, but the coefficients of correspondence between these tests computed on the basis of the scores of 42 eighth grade children present for all tests tend to show that there is less correspondence between the simple and complex tests (about 70 per cent.)<sup>1</sup> than between the various trials of the complex tests (about 85 per cent.) as far as rate of work is concerned, while for accuracy the correspondence is low in all tests (about 50 per cent.) (Table XLIII, page 187).

In spite of this lack of correspondence between individual scores, the class scores of the identical tests agree almost exactly. The median rate for the eighth grade scores was 8 examples attempted for both tests, while the median accuracy in the one class was 74 per cent. and in the other, 75 per cent. Similar results are usually obtained whenever a series of tests of the same type of ability, but of graded complexity, are used together. Under the circumstances, it is safest to regard each test as measuring a separate ability, and to make no inferences from one test to another, except on the basis of actual results.

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<sup>1</sup>See Chapter XI of Appendix A, page 475.

## COMPUTATION OF MEDIAN

The methods of tabulation and of computing medians need explanation. The form of record sheet for the Series B tests was the standard record sheet designed for the tests and in general use throughout the country. The method of computing medians was the approximate method also in general use in these tests. But because of the low scores made by the Gary children, this method does not always yield exact results. The differences, where they occur, however, are in the main favorable to the Gary children, tending to raise their scores above the true level.

An illustration will make this plain. In Figure 32, page 189, are shown two forms of tabulation sheet. The one at the left of the figure is the standard sheet, although not arranged in the conventional manner. The sheet is designed to show the relation between rate of work and accuracy, and to enable the accuracy to be found readily without unnecessary computation.

The rate scores are shown along the left of the sheet, and the total distribution for rate of work in the column at the extreme right. This distribution is not distorted in any way, and from it the true median may be found.

The actual scores made by a child are in terms of examples tried and examples right, as 6 tried and 5 right. Such scores, however, should be described in terms of rate and accuracy of work. Rate is, of course, the number of examples finished per unit of time, or,

TABLE XLIII  
RELATION BETWEEN RESULTS FROM DIFFERENT DIVISIONS OF  
CLEVELAND ARITHMETIC TESTS

Multiplication (Sets C, G and L). Based upon Scores of Eighth Grade. Total number of cases, 42. Also relation of Scores in Test C (Set L, Cleveland Arithmetic Test) to Tests D and E.

D and E are two trials of the same test as C, except that the time allowance is six minutes instead of three, and that the tests were given at a different time and as part of the Series B tests.

| CLEVELAND<br>ARITHMETIC<br>TEST | MEDIAN |          | MEDIAN<br>DEVIATION |          | . TOTAL RANGE |          |
|---------------------------------|--------|----------|---------------------|----------|---------------|----------|
|                                 | RATE   | ACCURACY | RATE                | ACCURACY | RATE          | ACCURACY |
| A                               | 14     | 93.5     | 8                   | 6.5      | 7-22          | 75-100   |
| B                               | 6      | 86.0     | 1                   | 14.0     | 3- 8          | 83-100   |
| C                               | 5      | 63.5     | 1                   | 19.5     | 1- 7          | 0-100    |
| D                               | 8      | 74.0     | 2                   | 15.0     | 2-12          | 0-100    |
| E                               | 8      | 75.0     | 1                   | 14.0     | 2-13          | 0-100    |

PERCENTAGE OF TOTAL CASES WHICH DO NOT VARY IN POSITION  
MORE THAN ONE UNIT, OR ONE HALF A UNIT OF VARIABILITY

| COMPARISON          | RATE   |                    | ACCURACY |                    |
|---------------------|--------|--------------------|----------|--------------------|
|                     | 1 UNIT | $\frac{1}{2}$ UNIT | 1 UNIT   | $\frac{1}{2}$ UNIT |
| Test A with B. .... | 71     | 40                 | 50       | 29                 |
| " A " C. ....       | 67     | 36                 | 60       | 21                 |
| " B " C. ....       | 98     | 43                 | 50       | 19                 |
| " C " D. ....       | 86     | 62                 | 40       | 26                 |
| " C " E. ....       | 81     | 29                 | 38       | 14                 |
| " D " E. ....       | 76     | 50                 | 55       | 24                 |

This table is to be read as follows: If the relation of the scores of individual children in number of examples attempted in Test A to the median number made by the class as a whole be compared with the relation of the same individual scores in Test B to the median number of examples made by the class as a whole, 71 per cent. of the children will be found to have maintained the same relative position in the two sets of scores within one unit of variability. That is, within three examples in Test A, or one example in Test B.

more simply, the number of examples finished, since all the grades have the same time allowance. The accuracy is the relation of the number of examples right to the number of examples tried, expressed as a rate per cent. To avoid the computation necessary to find the accuracy in each case, the record sheet is divided into vertical columns, each corresponding to a given range of accuracy. To enable the scores to be entered directly on the record sheet without the necessity of this computation, the small figures under the rate score show for each rate the accuracy column in which the given right score would fall. Thus, to enter the score 6 *examples* tried and 5 *right*, the tabulator would look up at the rate column until 6 was found, then move horizontally across the "six" row until 5 was found. One tally would then be marked in this rectangle, and a glance at the top of the column would show that the accuracy was from 80 per cent. to 89 per cent., average 85 per cent.

The accuracies thus found are only approximate, but for all columns except the lowest the result will never differ from the true accuracy by more than 5 per cent. at the most. In the illustration above the difference is 2 per cent. (85-83). On the average, the difference will be much less than this amount, and will as often be positive as negative. This statement does not apply to the last column where the variation in accuracy may amount to 25 per cent., although usually it is less than this amount. However, as it makes little difference in

FIGURE 32

Frederick  
Class  
Record  
Sheet

Grade 4A

Gary Public Schools

ARITHMETIC

No. 28  
Test 5

G

CONVENTIONAL  
TABULATION

Examiner.....Soulen  
Date.....6-1-16..... Hour 11-15  
Scores.....Rate 5.00 Accuracy 52 Efficiency 3%  
4.84 50

| RATE          | PER CENT. OF ACCURACY |          |       |     |       |             |       |         |       |     | TOTAL<br>FREQUENCY<br>RATE |   |           |     |       |     |
|---------------|-----------------------|----------|-------|-----|-------|-------------|-------|---------|-------|-----|----------------------------|---|-----------|-----|-------|-----|
|               | 100                   |          | 90    |     | 80    |             | 70    |         | 60    |     |                            |   | 50        |     | 49-0  |     |
|               | Score                 | Fr.      | Score | Fr. | Score | Fr.         | Score | Fr.     | Score | Fr. |                            |   | Score     | Fr. | Score | Fr. |
| 10            | 10                    | —        | 9     | —   | 8     | —           | 7     | —       | 6     | —   | 5                          | — | 4         | 1   |       |     |
| 9             | 9                     | —        | 8     | —   | 7     | —           | 6     | —       | 5     | —   | 4                          | — | 3         | 1   |       |     |
| 8             | 8                     | —        | 7     | —   | 6     | —           | 5     | —       | 4     | —   | 3                          | — | 2         | —   |       |     |
| 7             | 7                     | —        | 6     | —   | 5     | —           | 4     | —       | 3     | —   | 2                          | — | 1         | —   |       |     |
| 6             | 6                     | —        | 5     | —   | 4     | —           | 3     | —       | 2     | —   | 1                          | — | 0         | —   |       |     |
| 5             | 5                     | —        | 4     | —   | 3     | —           | 2     | —       | 1     | —   | 0                          | — | 0         | —   |       |     |
| 4             | 4                     | —        | 3     | —   | 2     | —           | 1     | —       | 0     | —   | 0                          | — | 0         | —   |       |     |
| 3             | 3                     | —        | 2     | —   | 1     | —           | 0     | —       | 0     | —   | 0                          | — | 0         | —   |       |     |
| 2             | 2                     | —        | 1     | —   | 0     | —           | 0     | —       | 0     | —   | 0                          | — | 0         | —   |       |     |
| 1             | 1                     | —        | 0     | —   | 0     | —           | 0     | —       | 0     | —   | 0                          | — | 0         | —   |       |     |
| 0             | 0                     | —        | 0     | —   | 0     | —           | 0     | —       | 0     | —   | 0                          | — | 0         | —   |       |     |
| Total %       | —                     | 3<br>11% | —     | —   | —     | 2<br>7%     | —     | 2<br>7% | —     | —   | 5<br>19%                   | — | 13<br>48% | 27  |       |     |
| Median Scores | Rate 5.0              |          |       |     |       | Accuracy 52 |       |         |       |     | Efficiency 3%              |   |           |     |       |     |
|               | Rights 1.7            |          |       |     |       |             |       |         |       |     |                            |   |           |     |       |     |

The above is a copy of a tabulation sheet used for arithmetic test Series B. The rate scores are indicated along the left hand border, accuracy scores along the top. The small figures placed within each square denote the number of examples right. For instance, two children made a score of 4 examples attempted and had 4 right, while one attempted 4 examples and had 3 right, one attempted 4 examples and had 2 right, two attempted 4 examples and had either one or none right. The other figures in the squares denote the frequency with which the given score occurs. The distribution for frequency is shown by the column at the bottom of the table. The two columns at the extreme right show the conventional form of tabulations of examples right. Efficiency is defined as the per cent. of the class able to work at standard rate for the grades and with perfect accuracy.



meaning whether an accuracy score is 37 per cent. or 12 per cent., when both are so low as to be of no practical value, the errors in this part of the scale are not serious.

The source of the error lies in the fact that scores of widely different values are grouped together. If the reader will refer to Figure 32, he will see that three children who made scores of 6 examples right have scores for examples right which bring them into the lowest accuracy column. These scores may be either 2, 1, or 0 examples right, the record sheet does not discriminate between them. On the average, the scores will be 1 and the accuracy 16 per cent., but if in a particular case they happen to be either 2 or 0 the actual accuracy will be either 33 per cent. or 0.

In the case of the Gary scores, the effect of such lack of discrimination is to raise the accuracy scores. If the conventional distribution of the scores for examples right is made as shown in the tabulation in the table on the right of Figure 32, the median score for examples right will be 1.7 examples. The class accuracy based upon the median score of five examples attempted would accordingly be 34 per cent. instead of 52 per cent., as shown by the form of tabulation used. Such large differences, however, occur infrequently. To check these results, the scores of all fourth and eighth grade classes were tabulated both ways.

For instance, in addition, in 79 per cent. of the cases the differences are either zero, or show that the accuracy

TABLE XLIV

DIFFERENCES IN THE ACCURACIES OF FOURTH AND EIGHTH GRADE CLASSES<sup>1</sup>

| OPERATIONS          | NUMBER OF TIMES |              | TOTAL CASES | SUM OF DIFFERENCES | AVERAGE DIFFERENCES |
|---------------------|-----------------|--------------|-------------|--------------------|---------------------|
|                     | STANDARD LARGER | RIGHT LARGER |             |                    |                     |
| Addition. ....      | 26              | 7            | 33          | 165                | 5.0                 |
| Subtraction. ....   | 27              | 6            | 33          | 242                | 7.3                 |
| Multiplication. . . | 24              | 8            | 32          | 149                | 4.7                 |
| Division. ....      | 23              | 6            | 29          | 183                | 6.3                 |
| Total. ....         | 100             | 27           | 127         | 739                | 5.8                 |

<sup>1</sup>As tabulated in the Standard Record Sheet and as computed from a tabulation of scores for examples right.

This table is to be read as follows: 33 class scores as to accuracy in addition were computed in two ways. One, using the standard form of record sheet shown in Figure 32, and the other, tabulating the number of examples correctly worked and computing the accuracy from the median number of examples right compared with the median number of examples attempted. In 26 cases the first method yielded larger results; in 7 cases the second method yielded larger results. The sum of the 33 differences in scores, without respect to sign, is 165 per cent., the average difference, 5 per cent. The average difference for 127 cases is 5.8 per cent.; that is, four times out of five the standard method yields scores which are, on the average, 6 per cent. higher than they would have been had they been computed from the number of examples worked correctly.

as determined by the standard record sheet is higher than when determined from the number of examples right. (Table XLIV, page 191). The average amount of this difference is 6 per cent. The accuracy scores in the tables of this report, therefore, are either the true scores or scores too high by an amount which, on the average, will be 6 per cent.

## THE GARY SCHOOLS

TABLE XLV  
CLASS SCORES IN JEFFERSON SCHOOL IN TWO TRIALS OF SERIES B

| CLASS<br>NUMBER | OFFICIAL<br>GRADE IN<br>JUNE | ADDITION     |              |       |                 |              |       | SUBTRACTION  |              |       |                 |              |       |
|-----------------|------------------------------|--------------|--------------|-------|-----------------|--------------|-------|--------------|--------------|-------|-----------------|--------------|-------|
|                 |                              | Rate Scores  |              |       | Accuracy Scores |              |       | Rate Scores  |              |       | Accuracy Scores |              |       |
|                 |                              | 1st<br>Trial | 2nd<br>Trial | Diff. | 1st<br>Trial    | 2nd<br>Trial | Diff. | 1st<br>Trial | 2nd<br>Trial | Diff. | 1st<br>Trial    | 2nd<br>Trial | Diff. |
| 9               | 4C                           | 4.0          | 4.0          | 0     | 22              | 32           | +10   | 3.7          | 4.1          | + .4  | 35              | 47           | +12   |
| 12              | 4B                           | 4.1          | 3.7          | -.4   | 34              | 50           | +16   | 4.7          | 4.4          | -.3   | 43              | 53           | +10   |
| 12              | 4A                           | 4.7          | 4.0          | -.7   | 53              | 50           | -3    | 4.0          | 5.0          | +1.0  | 53              | 38           | -15   |
| 11              | 5C                           | 4.0          | 4.3          | +.3   | 41              | 39           | -2    | 4.6          | 4.6          | 0     | 33              | 38           | +5    |
| 10              | 5B                           | 4.5          | 5.5          | +1.0  | 40              | 28           | -12   | 4.3          | 6.0          | +1.7  | 60              | 55           | -5    |
| 10              | 5A                           | 5.0          | 5.2          | +.2   | 50              | 46           | -4    | 5.2          | 5.4          | +.2   | 54              | 52           | -2    |
| 15              | 6A                           | 6.8          | 6.3          | -.5   | 36              | 36           | 0     | 6.5          | 6.4          | -.1   | 43              | 44           | +1    |
| 13              | 6C                           | 6.9          | 7.2          | +.3   | 42              | 50           | +8    | 6.8          | 7.4          | +.6   | 50              | 52           | +2    |
| 16              | 7C                           | 7.9          | 7.7          | -.2   | 32              | 42           | +10   | 7.8          | 7.6          | -.2   | 60              | 60           | 0     |
| 17              | 7A                           | 7.5          | 6.6          | -.9   | 40              | 38           | -2    | 7.0          | 6.6          | -.4   | 75              | 84           | +9    |
| 17              | 7A                           | 8.3          | 9.0          | +.7   | 50              | 55           | +5    | 9.2          | 7.0          | -2.2  | 84              | 64           | -20   |
| 14              | 8A                           | 10.3         | 9.5          | -.8   | 64              | 60           | -4    | 11.0         | 10.4         | -.6   | 92              | 81           | -11   |

# ARITHMETIC

193

| Class Number | Official Grade in June | Multiplication |           |       |                 |           |       | Division    |           |       |                 |           |       |
|--------------|------------------------|----------------|-----------|-------|-----------------|-----------|-------|-------------|-----------|-------|-----------------|-----------|-------|
|              |                        | Rate Scores    |           |       | Accuracy Scores |           |       | Rate Scores |           |       | Accuracy Scores |           |       |
|              |                        | 1st Trial      | 2nd Trial | Diff. | 1st Trial       | 2nd Trial | Diff. | 1st Trial   | 2nd Trial | Diff. | 1st Trial       | 2nd Trial | Diff. |
| 9            | 4C                     | 3.3            | 3.5       | +.2   | 34              | 36        | +2    | 2.5         | 2.2       | -.3   | 27              | 31        | +4    |
| 12           | 4B                     | 3.4            | 4.0       | +.6   | 44              | 50        | +6    | 4.0         | 3.2       | -.8   | 31              | 32        | +1    |
| 12           | 4A                     | 3.6            | 4.3       | +.7   | 36              | 50        | +14   | 1.9         | 2.0       | +.1   | 29              | 31        | +2    |
| 11           | 5C                     | 3.0            | 4.0       | +.0   | 32              | 42        | +10   | 3.5         | 3.0       | -.5   | 27              | 23        | -4    |
| 10           | 5B                     | 5.0            | 5.7       | +.7   | 43              | 42        | -1    | 2.6         | 4.0       | +.1   | 29              | 29        | 0     |
| 10           | 5A                     | 4.3            | 4.5       | +.2   | 41              | 63        | +22   | 4.6         | 3.1       | -.5   | 29              | 36        | +7    |
| 15           | 5A                     | 6.0            | 5.2       | -.8   | 36              | 65        | +29   | 4.5         | 4.2       | -.3   | 31              | 38        | +7    |
| 13           | 6C                     | 6.3            | 6.3       | 0     | 60              | 57        | -3    | 4.3         | 4.1       | -.2   | 37              | 52        | +15   |
| 16           | 7C                     | 6.9            | 7.2       | +.3   | 63              | 53        | -10   | 5.1         | 4.6       | -.5   | 50              | 58        | +8    |
| 17           | 7A                     | 6.8            | 7.0       | +.2   | 72              | 70        | -2    | 5.4         | 5.7       | +.3   | 60              | 70        | +10   |
| 14           | 7A                     | 9.0            | 9.2       | +.2   | 66              | 66        | 0     | 6.6         | 7.5       | +.9   | 70              | 82        | +12   |
| 18           | 8A                     | 9.7            | 9.7       | 0     | 71              | 78        | +7    | 9.2         | 10.0      | +.8   | 81              | 95        | +14   |

This table is to be read as follows: Class No. 9 in the Jefferson School (4C grade) attempted 4.0 examples on the first trial in the addition test, and 4.0 examples on the second trial. That is, there was no difference in the rate scores as determined by the two trials. The accuracy on the first trial was 32 per cent., the accuracy on the second trial was 31 per cent., or a gain of 10 per cent. In subtraction the differences between the rate scores were .4 of an example, between the accuracy scores 12 per cent. In multiplication the differences between the rate scores were .3 of an example, between the accuracy scores 2 per cent. This class did not try the division test on the first trial.

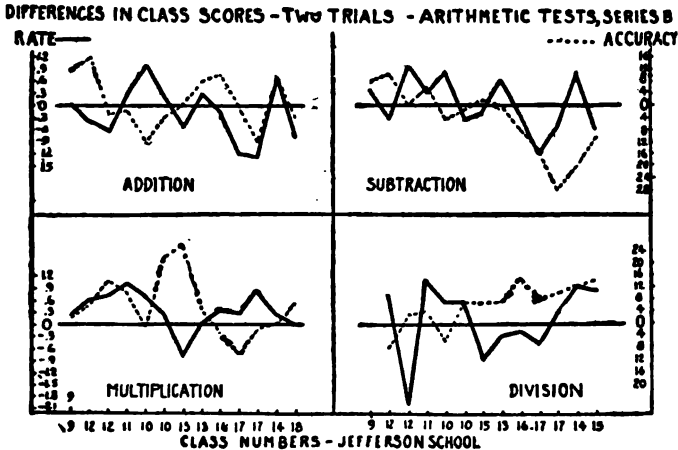
Note that the differences, in the main, are small, being less than one example in rate and less than 10 per cent. in accuracy, and that part of them are negative and part positive.

It may be contended that the median accuracy should have been computed from the accuracy of the individual papers. That this is better is conceded, but the time cost is prohibitive, and the advantage small. In the case of the class shown in Figure 32, page 189, for instance, the median class accuracy computed from the individual accuracies is 50 per cent. as compared with 52 per cent. computed from the standard record sheet and 34 per cent. computed from the median number of examples right. When the median accuracy does not fall much below 50 per cent. the standard method is much to be preferred because it preserves the scores in their fundamental relationships, and the results will differ very little, if at all, from those obtained in the longer, but more accurate method. Moreover, to be comparable with the results from other cities, the Gary results must have been obtained by the same methods. For these reasons the standard method was used at Gary in both the Series B and the Cleveland Tests. In the case of the Cleveland Tests, however, to make comparisons possible, it was necessary to tabulate all classes in both ways.

#### RELIABILITY OF MEASUREMENTS

As the Series B tests were given twice, the data afford a basis for the discussion of the reliability of a single test. For instance, the difference in the scores of the 13 classes in the Jefferson School which were tested twice with each of the four tests, 52 differences in all, is, for the most

FIGURE 33  
DIFFERENCES IN CLASS SCORES IN JEFFERSON SCHOOL FOR TWO TRIALS OF SERIES B<sup>1</sup>



Each quarter of the diagram is a graph of the results for one operation.

The scale along the base of the figures shows the numbers of the classes. In each diagram the straight line marked 0 represents the score made in the first trial. The scale along the left hand vertical axis shows the number of examples the rate score in the second trial is greater or less than the corresponding score in the first trial. The scale along the right hand vertical axis shows the number of per cent. the accuracy score in the second trial is greater or less than the corresponding score in the first trial. The solid line represents differences in rate. The dotted line represents differences in accuracy.

It should be noted (1) that there are no consistent differences in any of the diagrams, (2) that a gain in rate is often accompanied by a loss in accuracy, and vice versa, indicating that the changes in score are merely fluctuations in the methods of work, (3) that the differences are gross differences caused by changes in class membership, of changes in ability due to training, or changes caused by any other factors that may be operating.

<sup>1</sup>The tests were given five weeks apart.

FIGURE 33—*Continued*

In classes 9, 10, 11, and 12 in multiplication, the curves probably indicate growth due to training, but throughout the remainder of the diagrams there is little evidence of either growth or of consistent differences in difficulty between the two editions of the tests.

part, one example or less in the number of examples attempted and 10 per cent. or less in accuracy. Only about one difference in five will exceed these limits (Table XLV, page 192), and 55 out of 102 differences are positive. That is, the scores tend to be slightly higher on the second trial.

A careful study of these data, however, shows the variations are of two types. In some of the classes changes in rate and accuracy are in opposite directions, in others the two are in the same direction, and in still others there is practically no change (Figure 33). The results show plainly that a number of different factors are at work.

A factor that might cause change in scores is a change in difficulty from test to test. In the first trial, Form 3 of the Series B test was used, while in the second trial Form 4 was used. Form 4 is constructed to be of equal difficulty with Form 3 on an objective basis; that is, the same combinations were employed throughout, and, as nearly as possible, in the same arrangement. The variation in difficulty from one form to the other should not be large, but it is quite impossible to check the relative difficulty of the tests except by very carefully conducted experiments.

In the results shown in the previous table it will be seen that the classroom scores do not differ in any characteristic way. Sometimes the scores from Form 3 are larger than those from Form 4; sometimes they are smaller. These are indications that the differences are not caused by any marked differences in the difficulty of the tests themselves. As a further check upon the differences from test to test, the number of times each example was missed in Trial 1 and Trial 2 is tabulated. Some of the examples of Form 4 proved to be missed by a smaller number of children than in Form 3, and the others by a larger number, depending upon the operation (Table XLVI, page 198). The average difference per example was 2.6 per cent. In 60 per cent. of the cases the differences were positive.

There are also evidences of differences in difficulty from examples to example. It must be remembered, however, that the children who complete the various examples are a different group, as only the most able children reach the later examples (Table XLVII, page 200). The results show that the units of which the tests are composed are fairly equal as measured by even the small number of scores at Gary and that the differences from test to test are not very great. Those who feel inclined to question the equality of the units of which the tests are composed, or the equality of Forms 3 and 4, should remember first that each group of four examples<sup>1</sup> of the addition tests call for the use of the same combinations,

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<sup>1</sup>The number is different for each operation.



TABLE XLVI  
RELATIVE DIFFICULTY OF FIRST TEN PROBLEMS IN FORM 3 AND FORM 4 OF SERIES B:

| OPERATION                | No. of Children | EXAMPLE NUMBER |     |     |     |     |     |     |     |     |     | TOTAL | AVERAGE |
|--------------------------|-----------------|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|---------|
|                          |                 | 1              | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |       |         |
| Addition<br>Form 3       | Attempting      | 100            | 46  | 98  | 99  | 95  | 91  | 74  | 58  | 41  | 25  | 780   | 78      |
|                          | Missing         | 46             | 40  | 47  | 42  | 42  | 42  | 33  | 24  | 15  | 5   | 328   | 33      |
| Form 4                   | % Missing       | 46             | 40  | 48  | 42  | 35  | 46  | 44  | 42  | 37  | 20  | 400   | 42*     |
|                          | Attempting      | 100            | 100 | 99  | 98  | 96  | 90  | 70  | 62  | 39  | 29  | 783   | 78      |
| Subtraction<br>Form 3    | Missing         | 55             | 45  | 37  | 36  | 32  | 36  | 27  | 18  | 6   | 10  | 302   | 30      |
|                          | % Missing       | 55             | 45  | 37  | 37  | 33  | 40  | 39  | 29  | 15  | 37  | 367   | 38*     |
| Form 4                   | % Missing       | 55             | 45  | 37  | 37  | 33  | 40  | 39  | 29  | 15  | 37  | 367   | 38*     |
|                          | Diff. Form 3-4  | -9             | -5  | +11 | +5  | +2  | +6  | +5  | +13 | +22 | -17 | +33   | 9.3     |
| Subtraction<br>Form 3    | Attempting      | 99             | 99  | 99  | 99  | 100 | 100 | 100 | 93  | 75  | 59  | 923   | 92      |
|                          | Missing         | 22             | 25  | 26  | 23  | 24  | 29  | 41  | 26  | 27  | 17  | 260   | 26      |
| Form 4                   | % Missing       | 22             | 25  | 26  | 23  | 24  | 29  | 41  | 28  | 36  | 29  | 283   | 28*     |
|                          | Attempting      | 100            | 100 | 100 | 100 | 100 | 100 | 98  | 87  | 67  | 50  | 902   | 90      |
| Multiplication<br>Form 3 | Missing         | 27             | 12  | 33  | 12  | 36  | 28  | 25  | 31  | 24  | 10  | 238   | 24      |
|                          | % Missing       | 27             | 12  | 33  | 12  | 36  | 28  | 25  | 36  | 36  | 20  | 265   | 27*     |
| Form 4                   | % Missing       | 27             | 12  | 33  | 12  | 36  | 28  | 25  | 36  | 36  | 20  | 265   | 27*     |
|                          | Diff. Form 3-4  | -5             | +13 | -7  | +11 | -12 | +1  | +16 | -8  | 0   | +9  | 18    | 1.8     |
| Multiplication<br>Form 3 | Attempting      | 97             | 98  | 97  | 98  | 98  | 98  | 84  | 75  | 58  | 46  | 849   | 85      |
|                          | Missing         | 29             | 35  | 12  | 37  | 31  | 31  | 39  | 23  | 23  | 14  | 273   | 27      |
| Form 4                   | % Missing       | 30             | 36  | 12  | 38  | 32  | 31  | 46  | 31  | 40  | 30  | 336   | 32*     |
|                          | Attempting      | 100            | 100 | 97  | 98  | 95  | 98  | 89  | 78  | 60  | 47  | 882   | 86      |
| Form 4                   | Missing         | 27             | 22  | 34  | 31  | 30  | 26  | 36  | 30  | 20  | 11  | 266   | 27      |
|                          | % Missing       | 27             | 22  | 35  | 32  | 32  | 26  | 40  | 38  | 33  | 23  | 307   | 31      |
| Form 4                   | % Missing       | 27             | 22  | 35  | 32  | 32  | 26  | 40  | 38  | 33  | 23  | 307   | 31      |
|                          | Diff. Form 3-4  | +3             | +14 | -23 | +6  | 0   | +6  | +6  | -7  | +7  | +7  | 19    | 1.9     |

| Division<br>Form 3 | Attempting<br>Missing       | 100<br>23 | 100<br>32 | 97<br>16 | 91<br>17 | 77<br>19 | 69<br>16 | 59<br>6  | 47<br>9  | 33<br>4 | 22<br>5  | 696<br>147 | 70<br>15<br>21°<br>20 |
|--------------------|-----------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------|----------|------------|-----------------------|
|                    | % Missing                   | 23        | 32        | 16       | 19       | 25       | 23       | 10       | 19       | 12      | 23       | 202        |                       |
| Form 4             | Attempting<br>Missing       | 100<br>33 | 100<br>24 | 99<br>22 | 96<br>18 | 83<br>13 | 78<br>12 | 64<br>7  | 52<br>13 | 36<br>3 | 30<br>1  | 738<br>146 | 74<br>15              |
|                    | % Missing<br>Diff. Form 3-4 | 33<br>-10 | 24<br>+8  | 22<br>-6 | 19<br>0  | 16<br>+9 | 15<br>+8 | 11<br>-1 | 25<br>-6 | 8<br>+4 | 3<br>+20 | 176<br>26  | 20°<br>18<br>2.6      |

<sup>1</sup>Based on the frequency of errors per problem made by 100 ninth grade pupils.

<sup>2</sup>Was determined from average number attempted and average number missing. Should be compared with the average of the per cents. missing.

This table is to be read as follows: Of the 100 ninth grade children attempting example 1, Form 3, 46 wrote the incorrect sum on their papers. The per cent. of children missing was, therefore, 46. The per cent. missing the second example, Form 3, was 40, and so on. The average number trying the first 10 examples was 78, the average number missing was 33. The average per cent. missing, determined from these two figures, was 42. The average per cent. missing determined from the average of the per cents. missing each example was 40. The difference in the per cent. of the children missing the first example in Form 3 and the first example in Form 4 was -9. That is 9 children per hundred found the first example in Form 4 more difficult than that in Form 3. The average difference between Form 3 and Form 4 was 3.8 per cent. That is, Form 4, on the average, was 3 per cent. less difficult than Form 3. As the average per cent. of accuracy for Form 3 was 60 per cent. (100-40), the difference of 3 per cent. corresponds to an actual difference in difficulty of 5 per cent. The average difference is greatest for the addition test, and lowest for the subtraction test.

TABLE XLVII  
RELATIVE DIFFICULTY OF FIRST TEN PROBLEMS IN FORMS 3 AND 4 OF SERIES B—SUPPLEMENTARY

|                                                           | PER CENT. OF CHILDREN MISSING EXAMPLE<br>NUMBER |    |    |    |    |    |    |    |    |    | TOTAL | AVERAGE |
|-----------------------------------------------------------|-------------------------------------------------|----|----|----|----|----|----|----|----|----|-------|---------|
|                                                           | 1                                               | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |       |         |
| MULTIPLICATION FORM 3                                     |                                                 |    |    |    |    |    |    |    |    |    |       |         |
| Entire Group Table XLVI.....                              | 30                                              | 36 | 12 | 38 | 32 | 31 | 46 | 31 | 40 | 30 | 326   | 33      |
| 33 9th grade pupils who com-<br>pleted ten examples. .... | 24                                              | 27 | 24 | 42 | 27 | 33 | 33 | 15 | 31 | 27 | 283   | 28      |
| 36 10-12th grade pupils. ....                             | 47                                              | 46 | 33 | 46 | 31 | 61 | 59 | 41 | 42 | 39 | 445   | 44      |
| 71 5th grade pupils. ....                                 | 73                                              | 77 | 60 | 76 | —  | —  | —  | —  | —  | —  | 286   | 71      |
| MULTIPLICATION FORM 4                                     |                                                 |    |    |    |    |    |    |    |    |    |       |         |
| Entire Group Table XLVI.....                              | 27                                              | 22 | 35 | 32 | 32 | 25 | 40 | 38 | 33 | 23 | 307   | 31      |
| 33 9th grade pupils who com-<br>pleted ten examples. .... | 31                                              | 18 | 33 | 18 | 44 | 27 | 27 | 31 | 31 | 31 | 291   | 29      |
| 36 10-12th grade pupils. ....                             | 36                                              | 37 | 31 | 26 | 35 | 34 | 44 | 34 | 34 | 30 | 341   | 34      |
| 71 5th grade pupils. ....                                 | 38                                              | 51 | 45 | 60 | —  | —  | —  | —  | —  | —  | 194   | 49      |

TABLE XLVII—*Continued*

This table is to be read as follows: Example 1, multiplication test, Form 3, was missed by 30 per cent. of the ninth grade children, by 24 per cent. of a group of 33 ninth grade children who finished the entire ten examples, by 47 per cent. of a group of 36 10th to 12th grade children, by 73 per cent. of a group of fifth grade children. In other words, the table supplies four determinations of relative difficulty of the first four examples, based upon the performances of groups of children of different abilities. It should be noted that there are marked variations in the relative difficulty of the different examples as determined by the different groups. Thus, example 3, Form 3, is missed in the ninth grade by less than half as many children as example 1, but in the group of 33 ninth grade children who completed 10 examples the numbers of children missing the 1st and 3rd examples are equal. Similarly, for Form 4, the 3rd example is harder than the 1st example, according to the results of the first group, nearly equal according to the results of the second group, easier according to the results of the third group, and harder according to the results of the fourth group. In other words, the determination of relative difficulty of units of small groups of children within any one school system does not yield consistent results.

so that the four examples taken together make one unit; second, that Form 4 is made directly from Form 3 so that any child taking one form and then the other is called upon to do exactly the same work (Figure 34, page 202); and, third, that the data in the table are too few to eliminate the effects of chance and individual variation. Moreover, even the Gary class results previously discussed show that the variations in class scores from one form to another are relatively insignificant. Under the circumstances, the discussion above shows that in spite of all the factors operating to produce variation, the two tests are equal within about 5 per cent. or less.

One of the most important factors causing a difference

## THE GARY SCHOOLS

FIGURE 34  
CONSTRUCTION OF FORM 4 FROM FORM 3

| FIRST FOUR EXAMPLES OF FORM 3 |       |       |       | EXAMPLES RESOLVED INTO COLUMNS |    |    |    |    |    |    |    |    |    |    |    |  |
|-------------------------------|-------|-------|-------|--------------------------------|----|----|----|----|----|----|----|----|----|----|----|--|
|                               |       |       |       | No. 1                          | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |  |
| 339                           | 799   | 952   | 937   | 3                              | 3  | 9  | 7  | 9  | 9  | 9  | 5  | 2  | 9  | 3  | 7  |  |
| 276                           | 584   | 397   | 274   | 2                              | 7  | 6  | 5  | 8  | 4  | 3  | 9  | 7  | 2  | 7  | 4  |  |
| 977                           | 135   | 535   | 468   | 9                              | 7  | 7  | 1  | 3  | 5  | 5  | 3  | 5  | 4  | 6  | 8  |  |
| 861                           | 647   | 669   | 836   | 8                              | 6  | 1  | 6  | 4  | 7  | 6  | 6  | 9  | 8  | 3  | 6  |  |
| 757                           | 624   | 386   | 323   | 7                              | 5  | 7  | 6  | 2  | 4  | 3  | 8  | 6  | 3  | 2  | 3  |  |
| 698                           | 512   | 974   | 485   | 6                              | 9  | 8  | 5  | 1  | 2  | 9  | 7  | 4  | 4  | 8  | 5  |  |
| 269                           | 146   | 458   | 357   | 2                              | 6  | 9  | 1  | 4  | 6  | 4  | 5  | 8  | 3  | 5  | 7  |  |
| 136                           | 699   | 702   | 925   | 1                              | 3  | 6  | 6  | 9  | 9  | 7  | 0  | 2  | 9  | 2  | 5  |  |
| 322                           | 109   | 397   | 819   | 3                              | 2  | 2  | 1  | 0  | 9  | 3  | 9  | 7  | 8  | 1  | 9  |  |
| 4,635                         | 4,255 | 5,470 | 5,424 | 41                             | 48 | 55 | 38 | 40 | 55 | 49 | 52 | 50 | 50 | 37 | 54 |  |
|                               |       |       |       | Amt. car'd                     | 5  | 5  | 0  | 4  | 5  | 0  | 5  | 5  | 0  | 4  | 0  |  |
|                               |       |       |       |                                | 46 | 53 | 55 | 42 | 45 | 55 | 54 | 57 | 50 | 54 | 42 |  |

| COLUMNS REARRANGED |    |   |   |   |   |   |   |   |    |   |    |   | COLUMNS COMBINED TO FORM<br>FIRST FOUR EXAMPLES OF FORM 4 |     |     |     |
|--------------------|----|---|---|---|---|---|---|---|----|---|----|---|-----------------------------------------------------------|-----|-----|-----|
| No.                | 10 | 2 | 6 | 1 | 5 | 9 | 4 | 8 | 12 | 7 | 11 | 3 | 939                                                       | 892 | 757 | 989 |
| 9                  | 2  | 3 | 9 | 3 | 9 | 2 | 7 | 5 | 7  | 9 | 3  | 9 | 274                                                       | 287 | 594 | 376 |
| 2                  | 7  | 4 | 2 | 9 | 8 | 7 | 5 | 9 | 4  | 3 | 6  | 6 | 475                                                       | 935 | 138 | 567 |
| 4                  | 4  | 7 | 5 | 9 | 3 | 5 | 1 | 3 | 8  | 5 | 6  | 7 | 867                                                       | 849 | 666 | 631 |
| 8                  | 3  | 6 | 7 | 8 | 4 | 9 | 6 | 6 | 6  | 6 | 3  | 1 | 354                                                       | 726 | 683 | 327 |
| 3                  | 5  | 4 | 7 | 2 | 2 | 4 | 5 | 7 | 5  | 3 | 8  | 8 | 492                                                       | 614 | 575 | 988 |
| 4                  | 4  | 9 | 2 | 6 | 1 | 4 | 5 | 7 | 7  | 9 | 5  | 9 | 366                                                       | 248 | 157 | 459 |
| 3                  | 6  | 6 | 2 | 4 | 8 | 8 | 1 | 5 | 0  | 4 | 5  | 6 | 939                                                       | 192 | 506 | 726 |
| 9                  | 3  | 9 | 1 | 9 | 2 | 2 | 5 | 0 | 5  | 7 | 2  | 6 | 729                                                       | 407 | 199 | 412 |
| 7                  | 2  | 9 | 4 | 0 | 7 | 7 | 1 | 9 | 9  | 4 | 1  | 2 |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |
|                    |    |   |   |   |   |   |   |   |    |   |    |   |                                                           |     |     |     |

This figure shows the method by which the examples of Form 4 were constructed from Form 3. The four examples were resolved into separate columns, numbered 1 to 12. A record was kept of the amount carried to each column from previous columns. The columns and the amounts carried were then rearranged as shown in the third part of the figure. The figures at the tops of the columns are the same as in the second part, however, the sums of certain columns would have been altered by the amount carried from the column before it. To average this difficulty the four figures enclosed in circles were altered so that when the amount to be carried is added to the first figure the partial sums for the remainder of the column will be identical with the partial sums in these same columns in their original positions in Form 3. These columns as rearranged were then combined to form the examples of Form 4. The child who adds the first four examples of Form 3 has precisely the same combinations in Form 4. In this objective sense, therefore, the two tests are equal. Similar care is taken in the reconstruction of the tests for each of the other operations.

TABLE XLVIII  
EFFECT OF CHANGE OF CLASS MEMBERSHIP UPON CLASS SCORES IN REPEATED TESTS<sup>1</sup>

|                              | INDIVIDUAL | RATE      |           | ACCURACY  |           | DIAGNOSIS           |
|------------------------------|------------|-----------|-----------|-----------|-----------|---------------------|
|                              |            | 1ST TRIAL | 2ND TRIAL | 1ST TRIAL | 2ND TRIAL |                     |
| Present 1st Trial Only . . . | 1          | 5         |           | 40        |           |                     |
|                              | 2          | 5         |           | 40        |           |                     |
|                              | 3          | 8         |           | 38        |           |                     |
| Present Both Trials. . . . . | 4          | 3         | 6         | 0         | 16        | Large Gain          |
|                              | 5          | 3         | 6         | 33        | 0         | Change in Method    |
|                              | 6          | 3         | 4         | 33        | 25        | Change in Method    |
|                              | 7          | 3         | 9         | 33        | 100       | Large Gain          |
|                              | 8          | 3         | 6         | 66        | 33        | Change in Method    |
|                              | 9          | 3         | 2         | 100       | 0         | Loss                |
|                              | 10         | 3         | 2         | 100       | 100       | Insigificant Change |
|                              | 11         | 4         | 5         | 75        | 60        | Change in Method    |
|                              | 12         | 4         | 3         | 100       | 100       | Insigificant Change |
|                              | 13         | 5         | 6         | 40        | 33        | Change in Method    |
|                              | 14         | 5         | 6         | 60        | 33        | Change in Method    |
|                              | 15         | 5         | 5         | 60        | 80        | Change in Method    |
|                              | 16         | 5         | 9         | 33        | 44        | Gain in Accuracy    |
|                              | 17         | 6         | 8         | 66        | 50        | Gain                |
|                              | 18         | 6         | 5         | 100       | 60        | Change in Method    |
|                              | 19         | 6         | 6         | 100       | 40        | Large Loss          |
|                              | 20         | 7         | 6         | 100       | 88        | Loss in Accuracy    |
|                              | 21         | 7         | 7         | 71        | 28        | Loss in Accuracy    |
|                              | 22         | 7         | 11        | 86        | 36        | Change in Method    |
|                              | 23         | 7         | 6         | 86        | 33        | Loss                |
|                              | 24         | 8         | 9         | 25        | 33        | Change in Method    |
|                              | 25         | 8         | 9         | 62        | 66        | Gain                |
|                              | 25         | 9         | 9         | 100       | 56        | Loss in Accuracy    |

|                           |    |   |    |
|---------------------------|----|---|----|
| Present 2nd Trial Only... | 26 | 1 | 0  |
|                           | 27 | 2 | 0  |
|                           | 28 | 3 | 33 |
|                           | 29 | 4 | 50 |
|                           | 30 | 4 | 75 |
|                           | 31 | 5 | 40 |
|                           | 32 | 6 | 40 |
|                           | 33 | 6 | 16 |
|                           | 34 | 7 | 57 |
|                           | 35 | 9 | 66 |

SUMMARY OF MEDIAN SCORES

|                            | RATE      |           |       | ACCURACY  |           |       |
|----------------------------|-----------|-----------|-------|-----------|-----------|-------|
|                            | 1ST TRIAL | 2ND TRIAL | DIFF. | 1ST TRIAL | 2ND TRIAL | DIFF. |
| Present 1st Trial Only ... | 5         | —         | —     | 40        | —         | —     |
| Present Both Trials .....  | 5         | 6         | +1    | 66        | 42        | -24   |
| Present 2nd Trial Only ... | 6         | 4.5       | —     | —         | 40        | —     |
| Entire Group .....         | 5         | 6         | +1    | 62        | 40        | -22   |

<sup>1</sup>Based on individual scores in subtraction, Series B, Class No. 28, 4A Grade, Froebel.

This table is to be read as follows: Individuals 1-3 were present for first test only; individuals 4-25 were present for both tests; individuals 26-35 were present for the second test only. Individual No. 4 attempted 3 examples in the first test and had none right; and 6 examples in the second trial with one right. His scores, therefore, show a large gain. Individual 5 worked more rapidly, but less accurately. The change in scores, therefore, represent merely a change in method of work and neither gain nor loss. Of the 22 individuals present for both trials, 5 show a gain in score, 6 a loss, and 11 no change or a change in method only. The scores for the class, as a whole, show only increased rate and decreased accuracy but the amount of the change is masked somewhat by the difference in attendance.



TABLE XLIX  
EFFECT OF CHANGE IN CLASS MEMBERSHIP UPON CLASS SCORES IN REPEATED TESTS<sup>1</sup>

|                              | INDIVIDUAL | DATE      |           | ACCURACY  |           | DIAGNOSIS        |
|------------------------------|------------|-----------|-----------|-----------|-----------|------------------|
|                              |            | 1ST TRIAL | 2ND TRIAL | 1ST TRIAL | 2ND TRIAL |                  |
| Present 1st Trial Only. .... | 1          | 3         |           | 33        |           |                  |
|                              | 2          | 5         |           | 0         |           |                  |
|                              | 3          | 5         |           | 0         |           |                  |
|                              | 4          | 5         |           | 40        |           |                  |
|                              | 5          | 6         |           | 50        |           |                  |
|                              | 6          | 7         |           | 14        |           |                  |
|                              | 7          | 7         |           | 42        |           |                  |
|                              | 8          | 7         |           | 71        |           |                  |
|                              | 9          | 8         |           | 75        |           |                  |
|                              | 10         | 8         |           | 100       |           |                  |
|                              | 11         | 11        |           | 18        |           |                  |
| Present Both Trials. ....    | 12         | 3         | 3         | 0         | 0         | No Change        |
|                              | 13         | 3         | 4         | 33        | 75        | Gain             |
|                              | 14         | 3         | 4         | 67        | 100       | Gain             |
|                              | 15         | 6         | 5         | 17        | 60        | Change in Method |
|                              | 16         | 6         | 7         | 33        | 71        | Gain             |
|                              | 17         | 6         | 8         | 50        | 38        | Change in Method |
|                              | 18         | 6         | 7         | 100       | 43        | Change in Method |
|                              | 19         | 7         | 7         | 0         | 23        | Gain in Accuracy |
|                              | 20         | 7         | 8         | 14        | 0         | Change in Method |
|                              | 21         | 7         | 8         | 28        | 0         | Change in Method |
|                              | 22         | 7         | 8         | 57        | 67        | Change in Method |

|                               |   |   |    |     |                  |
|-------------------------------|---|---|----|-----|------------------|
| 23                            | 7 | 8 | 71 | 62  | Change in Method |
| 24                            | 8 | 8 | 50 | 62  | Gain in Accuracy |
| 25                            | 9 | 6 | 22 | 33  | Change in Method |
| 26                            | 9 | 9 | 44 | 89  | Gain in Accuracy |
| 27                            | 9 | 9 | 67 | 78  | Gain in Accuracy |
| 28                            |   | 4 |    | 100 |                  |
| Present 2nd Trial Only. . . . |   |   |    |     |                  |

SUMMARY OF MEDIAN SCORES

|                                 | RATE      |           |       | ACCURACY  |           |       |
|---------------------------------|-----------|-----------|-------|-----------|-----------|-------|
|                                 | 1ST TRIAL | 2ND TRIAL | DIFF. | 1ST TRIAL | 2ND TRIAL | DIFF. |
| Present 1st Trial only. . . . . | 7         | —         | —     | 40        | —         | —     |
| Present Both Trials. . . . .    | 7         | 7         | 0     | 38        | 61        | +23   |
| Present 2nd Trial only. . . . . | —         | 4         | —     | —         | 100       | —     |
| Entire Group. . . . .           | 7         | 7         | 0     | 40        | 62        | +21   |

<sup>1</sup>Based on individual scores in multiplication, Series B, Class No. 43, 7A Grade, Froebel.

This table is to be read as follows: Individuals 1-11 were present for the first trial only; individuals 12-27 were present for both trials; individual 28 was present for the second trial only. Individual scores are to be interpreted the same as in previous table. Of the 16 individuals present for both trials, 7 show a gain, and 9 either no gain or a change of method. The scores for a class as a whole show a gain in accuracy which is masked somewhat by the change in class membership.

in score is the difference in the reaction of the children to the test situation. The first time the test is taken most individuals tend to hold themselves in restraint. They proceed cautiously, on the lookout for difficulties. On the second trial, however, when they know what to expect, they work more freely. The result is an increased rate and decreased accuracy.<sup>1</sup>

Many illustrations, both of increase in rate and decrease in accuracy, and increase in accuracy and decrease in rate were found. (Tables XLV and XLVIII.) All such differences will be said to be caused by a change in method of work. The amount of change in rate necessary to produce a given change in accuracy is, however, not known and apparently varies with the different classes and different individuals. Consequently in all cases of change of method it is impossible to tell whether or not there has been any real change of ability in the interval between tests.

A third factor which undoubtedly influences many scores is the change in class membership. Attention has already been called to the fact that attendance at Gary is exceedingly variable, and in the results previously given (Table XLV, page 192) no account has been taken of changes in membership. An analysis was made of the scores of the children from a class whose scores show a large loss to determine the effect of individual variation (Table XLVIII, page 204). There were 3 children present at the first trial who were absent on the second, 10 children pres-

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<sup>1</sup>See X of Appendix A, page 452.

ent the second trial who were not present the first trial. Of the 22 children present at both trials, the scores of 5 show a real gain, some of them in both rate and accuracy, 11 individuals show very little change, or else a change in method. That is, in this class, the large loss in accuracy is due almost entirely to the change of method of work, for the children present at both trials have increased their rate score one example, and lost in accuracy 24 per cent. This effect, however, is somewhat masked in the general class scores by the fact that children present at the first trial were less able than the average of the class, and tended to reduce the first class score.

A similar analysis was made for a class in which there was a larger gain in accuracy (Table XLIX, page 206). The results show that this gain was due partly to seven children who show a real gain, and partly to the fact that a number of children worked more slowly in the second test with increased accuracy, that is, to eight children who show an apparent gain in accuracy due to change in method. Analysis of random selections of other classes showing similar large differences gave similar results. Nothing was found to indicate that there were any real differences in difficulty between the two addition tests.

The fourth factor tending to produce change in score is school training. This is particularly true in the Beveridge school in which systematic drill work was observed following the first test. In most of the classes, however, there is no evidence that any great amount of change of score can be attributed to such cause. Most of the

variations shown in the table are due either to chance variations or to changes in method.

A tabulation of all the differences in the class scores in the two trials of the Series B tests in all schools showed (Table L, page 211) that about 10 per cent. of the classes made exactly the same score in the two tests, 78 per cent. of the classes made the same score in rate within one example, 62 per cent. made the same score in accuracy within 10 per cent. As the scores of the Gary children of the eighth grade average 8 examples, a change of one example worked correctly would mean a change in accuracy, if the rate scores were constant, of 12 per cent., so that about three fourths of the class scores do not vary more than one example in their rate or accuracy. The median of 211 differences between the class scores of the first and second trials of the tests is about one half an example in rate and 7.6 per cent. in accuracy.

Of these differences, the positive differences have a ratio to the negative differences of about 2:1, indicating the general tendency of the classes to make a higher score on the second test. This is undoubtedly due to the practice effects of repeating the test, as has already been indicated.

The reliability of the rate scores of a single test is high—about 90 per cent.<sup>1</sup> That is, only about 10 per cent. of the children will be misrepresented by their rate scores in any one test. In accuracy, however, variations

<sup>1</sup>Pearson's coefficient of reliability, 42 eighth grade children, rate scores addition, Trials 1 and 2, were + .90, P. E.  $\pm$  .02.

TABLE L

VARIATION IN CLASS SCORES IN TWO TRIALS OF SERIES B—FOUR  
OPERATIONS COMBINED<sup>1</sup>

| AMOUNT OF VARIATION <sup>2</sup> | FREQUENCY, RATE  |     | FREQUENCY, ACCURACY |     |
|----------------------------------|------------------|-----|---------------------|-----|
|                                  | NUMBER           | %   | NUMBER              | %   |
| 0                                | 19               | 10  | 24                  | 12  |
| 1-4                              | 81               | 38  | 54                  | 25  |
| 5-9                              | 64               | 30  | 54                  | 25  |
| 10-14                            | 30               | 14  | 44                  | 21  |
| 15-19                            | 8                | 4   | 19                  | 9   |
| 20-24                            | 9                | 4   | 16                  | 8   |
| Total                            | 211 <sup>3</sup> | 100 | 211 <sup>4</sup>    | 100 |
| Median                           | .55 Examples     |     | 7.6%                |     |

<sup>1</sup>Differences in rate and accuracy are distributed for grades 4-12.

<sup>2</sup>For rate of work the amount of variation represents tenths of an example. For accuracy the amount of variation represents per cent. of accuracy.

<sup>3</sup>73 scores were lower on second trial, 119 higher.

<sup>4</sup>63 scores were lower on second trial, 124 higher.

This table is to be read as follows: Of 211 repeated tests 19, or 10 per cent. of the whole made exactly the same median score in rate in both trials: 24, or 12 per cent. made exactly the same median score in accuracy. Half the classes varied .55 of an example or less in rate, and 7.6 per cent. or less in accuracy.

arise much more readily and the reliability of the tests is low. This is shown clearly by the coefficients of correspondence (Table LI, page 213). About three fourths of the children will maintain their relative positions in the distribution of rate scores through the two trials, and about 40 per cent. of the children in accuracy.<sup>1</sup>

<sup>1</sup>Pearson's coefficient of reliability, 42 eighth grade children, accuracy scores multiplication, Trials 1 and 2, was  $\pm .12$ , P. E.  $\pm .09$ .

It cannot be too strongly emphasized that educational measurements differ from measurements in the physical sciences chiefly in the fact that the quantities measured in education vary enormously with slight changes in conditions. The length of a metal rod is changed so little by temperature, pressure, and other factors that we come to think of the length as a quantity independent of the conditions. Ability to add correctly, on the other hand, is so dependent upon the conditions under which the adding is done that it can scarcely be said to exist independently of them. In other words, as has been repeatedly pointed out, a test does not measure ability, it merely registers performance under the given conditions.

The conditions revealed by the tests are not created by them. Whenever two separate measurements by the same test are possible, a greater range of individual variation than one would expect is always revealed. Many tests, however, cannot be repeated, and for very few are there available second editions of equal value to the first. The conclusion to be drawn from the repeated tests is, of course, that a series of tests is necessary to determine with any certainty the ability of an individual, but that variations in individual achievement take place in accordance with such fixed laws that class scores based on the scores of groups of children are very reliable. In other words, the scores made by the Gary children in the arithmetic tests are proved, by the repetition of the tests, to represent actual conditions. The

TABLE LI  
CORRESPONDENCE BETWEEN RESULTS OF TWO TRIALS OF  
SERIES B<sup>1</sup>

|                                            | MEDIAN |       | MEDIAN<br>DEVIATION |       | TOTAL RANGE |        |
|--------------------------------------------|--------|-------|---------------------|-------|-------------|--------|
|                                            | RATE   | ACCY. | RATE                | ACCY. | RATE        | ACCY.  |
| Addition, 1st.....                         | 8      | 61    | 2                   | 14    | 4-15        | 0-100  |
| Addition, 2nd. ....                        | 7.5    | 57    | 1.5                 | 14    | 3-15        | 0-100  |
| Subtraction, 1st. ....                     | 9      | 83    | 1                   | 8     | 6-16        | 14-100 |
| Subtraction, 2nd. ....                     | 9      | 79    | 1                   | 12    | 5-17        | 0-100  |
| Multiplication, 1st. ....                  | 8      | 74    | 2                   | 15    | 2-12        | 0-100  |
| Multiplication, 2nd. ...                   | 8      | 75    | 1                   | 14    | 2-13        | 0-100  |
| Division, 1st. ....                        | 7      | 83    | 1                   | 17    | 1-13        | 0-100  |
| Division, 2nd. ....                        | 7      | 84.5  | 1                   | 13.5  | 3-14        | 20-100 |
| Multiplication, Cleve-<br>land Tests. .... | 5      | 63.5  | 1                   | 19.5  | 1- 7        | 0-100  |

<sup>1</sup>Based on scores of 48 eighth grade pupils, tested at intervals of four weeks.

PERCENTAGE OF TOTAL CASES WHICH DO NOT VARY IN RELATIVE  
POSITION MORE THAN ONE (OR ONE HALF)  
UNIT OF VARIABILITY

| SERIES B<br><br>COMPARISON TRIAL 1 WITH 2               | RATE   |                    | ACCURACY |                    |
|---------------------------------------------------------|--------|--------------------|----------|--------------------|
|                                                         | 1 UNIT | $\frac{1}{2}$ UNIT | 1 UNIT   | $\frac{1}{2}$ UNIT |
| Addition. ....                                          | 78     | 55                 | 36       | 21                 |
| Subtraction. ....                                       | 78     | 36                 | 45       | 29                 |
| Multiplication. ....                                    | 76     | 50                 | 55       | 24                 |
| Division. ....                                          | 60     | 24                 | 31       | 12                 |
| Multiplication Trial 1 Series B<br>with Cleveland. .... | 86     | 62                 | 40       | 26                 |
| Multiplication Trial 2 Series B<br>with Cleveland. .... | 81     | 29                 | 38       | 14                 |

This table is to be read as follows: If in the first trial of the addition test, the relations of the scores of individual children to the score of the class as a whole be compared with similar data based upon the scores of the same individual in the second trial, 78 per cent. of the children will be found to have maintained the same relative position in the two sets of rate scores, and 36 per cent. in the two sets of accuracy scores, within one unit of variability. That is, within 2 examples for rate, and within 14 per cent. for accuracy.



scores made by the Gary children in all the tests of mechanical skills agree in showing that the Gary children work slowly and very inaccurately.

#### EFFECT OF TEST CONDITIONS

The claim is sometimes made that such poor work in the tests is due largely to the fact that the children are working under artificial conditions; that if occasion were to arise for the use of these same skills in the achievement of some purpose which seemed worthy of effort, the children would respond to the motivated situation in a manner which would prove their ability to cope with it.

This statement is both true and untrue. It is true that a slow, inaccurate worker will, under the spur of sufficient incentive, repeat his computations many times until he is finally able to arrive at the correct results. As has already been pointed out, by far the greater number of children tested both at Gary and in other school systems would be able to solve correctly every example in every test (except certain of the fraction tests) if a sufficient incentive should lead them to attempt such an achievement, and if there were no time limit. So far the claim above is based upon fact. The part of the statement that is not true is the implication that because two groups of children attain the same goal their achievements are equal, and the trainings which made the achievement possible are of equal value. For if the children of one school require less time than those of another school to accomplish the same task,

they are more skilful. The sole purpose of the arithmetic tests given at Gary was to determine the degree of skill possessed by the Gary children under the given conditions. Such measurements are of value because many persons have already determined for themselves the degree of skill they think a child of a given age or grade should have under the test conditions. The one additional point to be noted is that in the judgment of the survey staff the test is a suitable measure for the type of instruction found in the classrooms at Gary. If, therefore, the reader will realize that no attempt is being made to draw inferences from the results, other than in regard to the degree of skill in the mechanical operations of arithmetic, the discussions of this chapter will serve to show the degree of dependence that may legitimately be placed upon the conclusions reached.

## VI. ENGLISH COMPOSITION

### §1. GENERAL RESULTS

**L**ANGUAGE work at Gary is allotted 16 per cent. of the total time given to the fundamentals, and this corresponds almost exactly to the per cent. of time allowed this type of work in the average of fifty American cities. The actual number of hours at Gary, 798, is somewhat less than the average, 864 hours, in the conventional schools, but the difference is so slight that one may fairly say work of this type receives the same emphasis at Gary as elsewhere. English composition is the one phase of language work which is measurable at present. Such surveys as have been made in other school systems show that in general the products of school training in written composition are far from satisfactory. It was felt, however, that here, if anywhere, the training peculiar to Gary should produce results. Accordingly, a test of ability in English composition was given.

#### TESTS

No attempt was made to measure oral composition, and, of the four recognized forms of written composition, the testing work was limited to the simplest, narration. Children were asked to write a story of some interesting or exciting experience<sup>1</sup> of their lives. Subjects were

<sup>1</sup>The instructions and conditions of the Composition Test given in the Denver Survey were followed closely.

suggested, but the children were urged to choose for themselves, and, for the most part, they did. Children wrote freely in the presence of the examiners and were given ample time (fifteen to twenty minutes). The actual number of minutes and seconds taken by each child was noted, however.

#### SCORING

In all but the lowest grades the children counted the number of words written and later these scores were verified by the examiners. The papers were also scored for quality, for number of errors, and in other ways, all such scoring being done by trained men under carefully controlled conditions. The quality of the compositions was measured by means of the Hillegas Scale.<sup>1</sup>

#### RESULTS

A typical eighth grade composition is shown in Figure 35. The handwriting in the sample is a little better than the eighth grade median in handwriting (quality Ayres' Scale 45, actual eighth grade median in composition test 39, generalized score 42), and the misspellings are less frequent than for the median spelling paper for the eighth grade (spelling coefficient of the illustration, 8; median eighth grade spelling coefficient, 19.7), but in style, subject, structure, and range of vocabulary it is a representative paper. So far as it is not

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<sup>1</sup>A discussion of the reliability of measurement of quality in composition by the Hillegas Scale will be found in §2, page 247.

## THE GARY SCHOOLS

FIGURE 35

TEST No. 6 THE GARY PUBLIC SCHOOLS

NAME: William E. Bice BOY or GIRL: BOY AGE: 12 GRADE: 12 CLASS: 14

SCORE: 55  
 LENGTH: 125  
 TIME: 20 MIN.

DO NOT WRITE IN THIS MARGIN

| W | M | G |    |
|---|---|---|----|
|   |   |   | 1  |
|   |   |   | 2  |
|   |   |   | 3  |
|   |   |   | 4  |
|   |   |   | 5  |
|   |   |   | 6  |
|   |   |   | 7  |
|   |   |   | 8  |
|   |   |   | 9  |
|   |   |   | 10 |
|   |   |   | 11 |
|   |   |   | 12 |
|   |   |   | 13 |
|   |   |   | 14 |
|   |   |   | 15 |
|   |   |   | 16 |
|   |   |   | 17 |
|   |   |   | 18 |
|   |   |   | 19 |
|   |   |   | 20 |

An exciting experience  
 It was a very dark damp night  
 in the woods we went to sleep after  
 watching the storm after we had been  
 asleep about three hours we were  
 awakened by a queer rumbling noise  
 at first we were afraid we talked over  
 what we would do if the tent blew  
 away. The storm was growing worse.  
 The rain came down in torrents and  
 came through into the tent as deep  
 mist, we were all as wet it was  
 no use to try to sleep so we warmed  
 our selves over the gasoline stove the  
 storm grew worse and Carl went out  
 and loosened the guy ropes tightening  
 the tent down at the same time. It  
 seemed an hour before he came back  
 when all of a sudden we heard a  
 yell from outside we ran out and there

The scores on the Hillegas Scale assigned to this sample by five judges are 37, 40, 45, 55 and 65. Median value 45. Median quality of eighth grade composition for entire city, 45.8. This sample is, therefore, a representative paper.

Half of the eighth grade children wrote compositions equal to or better than this sample, and half compositions equal to or worse than this sample.

FIGURE 35—*Continued*

SAMPLE A

(HILLEGAS VALUE 45)

An Exciting experience

It was a very dark damp night in the woods, We went to sleep after watching the storm after we had been asleep about three hours we were awakened by a queer rumbling noise, at first we were afraid we talked over what we would do if the tent blew away. The storm was growing worse the rain came down in torrents and came through into the tent as a deep mist, we were all so wet it was no use to try to sleep so we warmed our selves over the gasoline stove, the storm grew worse and Earle went out and loosened the guy ropes tightening the tent down at the same time. It seemed an hour before he came back when all of a sudden we heard a yell from outside we ran out and there stood Earle horrified because as we looked through the trees down the beach came a sort of a misty red ball tearing up everything in front of it. It turned toward us but it was coming slowly we turned and ran into the tent put out the stove and ran for some bushes between some large trees. We got there just in time because when we dropped into the bushes we heard a crash and behind us, When we looked to see the rotten tree beside the tent had been torn down and unfortunatly fell on the tent tearing the canvas and breaking the center pole. That is the last hurrican we ever want to see

## FIGURE 36

## SAMPLE B

## PART OF AN EIGHTH GRADE COMPOSITION

(HILLEGAS VALUE 30)

As we went to spent our vacation I happen to be right near the mountains I was glad couse I could go and climb just as high as I want to already why I think abouve the clouds I want to rich the tops but couldnt couse there was ice and it was so sleapry to goe any further so we came back

So I went with my father and mother we went pvery hiegh. it was getting cold when we came down there was many more mountains and I disided to go on

Approximately 10 per cent. of the eighth grade compositions were as poor as this sample. Approximately half of the fourth grade papers were as poor as or worse than this sample.

FIGURE 36—*Continued*

## SAMPLE C

## EIGHTH GRADE COMPOSITION

(HILLEGAS VALUE 60)

One evening, about nine years ago, we left Rochester N. Y. for a trip up the St. Lawrence River. There were four in our party, a cousin, Mother, Father, and myself. Going up the river it was rather rough and it being my first experience on a boat I was rather sick, altho the thot of sleeping in a boat all night was a most interesting one for me.

Coming home, the second evening we had been on the boat, we were all sitting on the deck. The sun was just setting in the west. The reflection on the water was made up of goldenpink and a little bit of red. The water on one side of the boat was like glass. On the other side it was rippling just a trifle and the reflection seemed to be lavender. This was one of the most beautiful sights I had seen and as young as I was I remember it yet.

I sat and gazed upon the water, with my doll in my arms, until I fell asleep.

Approximately 10 per cent. of the eighth grade papers were equal to or better than this sample. Approximately half of the twelfth grade papers were equal to or better than this sample. Approximately 80 per cent. of the eighth grade papers would fall between Sample B and Sample C.

representative, the sample is better, not worse, than the typical eighth grade product. The specimen therefore provides the reader with the opportunity to see for himself the



degree of merit in English composition which represents the outcome of eight years' training in writing English.

The amount of progress from the fourth to the twelfth grades is from quality 29.9 to 62.2 Hillegas (Table LII) and may be observed in the difference between samples "B" and "C" in Figure 36, page 220. Sample "B" represents the median quality of the fourth grade papers, and sample "C" the median quality of the twelfth grade papers. Approximately 80 per cent. of the eighth grade papers fall between these limits; that is, a little less than 10 per cent. of the eighth grade papers are as poor as, or poorer than, sample "B," and no more than 10 per cent. of the eighth grade papers are equal to, or exceed, sample "C."

A study of the complete distribution of the scores assigned to the papers in the Gary composition test show that of the entire group of 1429 children tested, but 29 have papers of quality 70 or better,<sup>1</sup> and all but one of these are found in the high school grades (Table LIII, page 224). This means that very few of the children have much power in the selection of subject matter, the organization of material, or the choice of words.

Composition ability changes in rate in a uniform way up to the ninth grade, but there is little further progress. In quality there is but 3 points difference (32.8-29.9)

<sup>1</sup>Reference to the analysis of the composition scale, page 245, and to the samples in Appendix A, page 416, will show that quality 70 is the lowest quality that represents a desirable end product. It is only fair to Gary to add that standards based on the actual achievements of children fall far below 70. True eighth grade standard, 50. Nineteen per cent. of the 1429 pupils equaled or exceeded quality 50. If eighth and higher grades only are considered the percentage 50 or better would be 54%.

TABLE LII

QUALITY OF ILLUSTRATIVE SAMPLES—ENGLISH COMPOSITION

| SAMPLE | SOURCE:<br>SCHOOL | GRADE | MEDIAN QUALITY<br>ON HILLEGAS<br>SCALE<br>(5 JUDGES) | QUALITY EQUALED<br>OR EXCEEDED BY |
|--------|-------------------|-------|------------------------------------------------------|-----------------------------------|
| B      | Froebel           | 8th   | 30, Av. Dev. 3.6                                     | 50% of 4th grade                  |
| A      | Emerson           | 8th   | 45, Av. Dev. 8.6                                     | 50% of 8th grade                  |
| C      | Jefferson         | 8th   | 60, Av. Dev. 7.6                                     | 50% of 12th grade                 |

ESSENTIAL COMPARISONS OF THE RANGE IN ABILITY IN ENGLISH  
COMPOSITION IN TERMS OF HILLEGAS UNITS

| GRADE            | 4    | 8    | 12   |
|------------------|------|------|------|
| Highest 10%..... | 39.1 | 60.0 | 70.0 |
| Highest 30%..... | 34.4 | 50.5 | 65.9 |
| Median.....      | 29.9 | 45.8 | 62.2 |
| Lowest 30%.....  | 24.9 | 41.4 | 58.5 |
| Lowest 10%.....  | 18.8 | 34.2 | 48.8 |

The table is to be read as follows: Sample B was written by an eighth grade child in the Froebel School. It is rated as value 30 on the Hillegas Scale (average deviation of five judgments, 3.6 points). Its quality is equaled or exceeded by 50 per cent. of the fourth grade papers.

The 10 per cent. of the children making the highest scores in the fourth grade were rated 39.1 Hillegas or better; in the eighth grade, 60.0 Hillegas or better; in the twelfth grade, 70.0 Hillegas or better.

## THE GARY SCHOOLS

TABLE LIII  
DISTRIBUTION OF SCORES SHOWING FREQUENCY WITH WHICH EACH MARK WAS ASSIGNED IN EACH GRADE

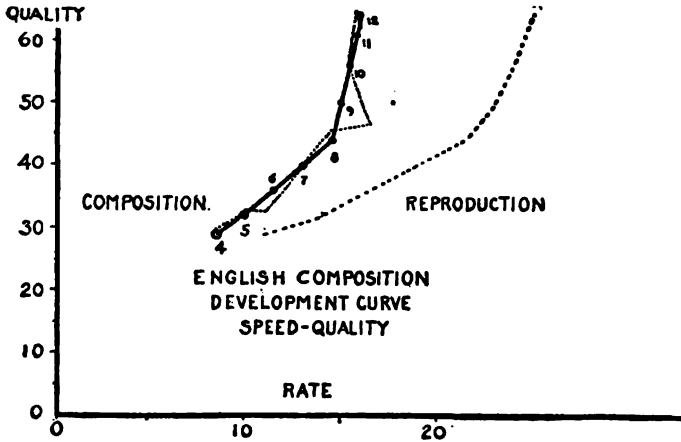
| HILLEGAS<br>UNITS  | GRADE |      |      |      |      |      |      |      |      |       | TOTAL | %  |
|--------------------|-------|------|------|------|------|------|------|------|------|-------|-------|----|
|                    | 4     | 5    | 6    | 7    | 8*   | 9    | 10   | 11   | 12   |       |       |    |
| 80                 | —     | —    | —    | —    | —    | —    | —    | —    | —    | —     | 2     | —  |
| 70                 | —     | —    | —    | —    | —    | —    | —    | —    | —    | —     | 27    | 2  |
| 60                 | 1     | 1    | —    | —    | 11   | 7    | 6    | 14   | 4    | 23    | 85    | 6  |
| 50                 | —     | 4    | 5    | 17   | 26   | 46   | 34   | 16   | 13   | 161   | 11    | 11 |
| 40                 | 14    | 25   | 31   | 95   | 55   | 75   | 17   | 4    | 8    | 319   | 22    | 22 |
| 30                 | 106   | 156  | 89   | 97   | 29   | 25   | 4    | —    | 2    | 508   | 36    | 36 |
| 20                 | 98    | 88   | 62   | 19   | —    | 1    | —    | —    | —    | 268   | 19    | 19 |
| 0-19               | 26    | 18   | 13   | 2    | —    | —    | —    | —    | —    | 59    | 4     | 4  |
| Total.....         | 245   | 292  | 200  | 230  | 122  | 156  | 84   | 55   | 45   | 1,429 | 100   |    |
| Median.....        | 29.9  | 32.6 | 32.8 | 39.7 | 45.8 | 46.9 | 56.2 | 64.2 | 62.2 | 37.6  |       |    |
| Generalized Values | 29    | 32   | 36   | 40   | 44   | 50   | 56   | 61   | 64   |       |       |    |

\* Scored by five judges.

This table is to be read as follows: Of 245 fourth grade composition papers scored by one judge, one sample is rated 60; 14 were given values ranging from 40-49; 106, from 30-39; 98, from 20-29; and 26, from 0-19. The median score of the group was taken as 29.9. The value adopted as the generalized city wide score was 29.

FIGURE 37

## DEVELOPMENT IN COMPOSITION



Scale along the base of the figure—rate in number of words written per minute. Scale along the vertical axis—quality on the Hillegas Scale. Solid line—composition; dotted line—reproduction of simple story after one reading. Small circles on composition curve indicate position of grade scores in both rate and quality. The small figures near circles show grades. The reproduction curve is based upon the actual rates of reproduction and the quality of the composition test. The eighth grade quality of reproduction was judged to be equal to that of composition, but the dotted line, as a whole, represents a theoretical line. The curve was drawn to make evident the actual difference in rate of writing between reproduction and composition. The difference increases from grade to grade and the curves show that quality in the Gary schools is produced at the expense of rate.

Note that the light dotted line which represents the actual scores for development of ability in English composition begins to rise rapidly in the sixth grade, and that the growth during high school years is almost

FIGURE 37—*Continued*

entirely in quality. To conform to results in conventional schools the composition curve should have the same general form as the curve for reproduction and fall half way between the two curves in the figure.

between the fourth and sixth grade, but the change from the sixth to the eighth grade is 13 points. The eighth grade median score is nearly 46 Hillegas. The ninth grade is but slightly higher, but the tenth and eleventh grade scores raise the level 18 points. The twelfth grade score is lower than that of the eleventh grade. That is, of the 34.3 points of difference in quality between the fourth and eleventh grades, 30.2 points gain is made in four of the grades. The growth in high school grades is almost wholly in quality. (Tables LIII, LIV, pages 224, 227, Figure 37, page 225).

Teachers of English hold that in compositions there should be increasing freedom from error from grade to grade, and increasing power both to choose the words best adapted to the expression of a given thought and to organize the words chosen into coherent discourse. Accordingly, the eighth grade papers were subjected to a series of analyses to determine the number and character of the various errors made. Papers were marked for errors in capitalization, punctuation, spelling and grammar and were also analyzed as to range of vocabulary.

On the average, a Gary eighth grade child makes .8 of an error in capitalization, 1.8 errors in punctuation, and 3.9 errors in grammar, or a total of 6.4 errors in writing an original composition of 214 words (Table LV, page

TABLE LIV  
CITY WIDE GENERALIZED RATE OF WRITING AND OF REPRODUCTION

| GRADE                                                         | RATE OF<br>WRITING.<br>WORDS<br>PER<br>MINUTE | QUALITY<br>OF<br>COMPOSITION | RATE OF<br>REPRODUCING<br>STORY. WORDS<br>PER MINUTE | COMPARATIVE DATA<br>GENERAL TABULATIONS†<br>RATE OF WORK |                                |
|---------------------------------------------------------------|-----------------------------------------------|------------------------------|------------------------------------------------------|----------------------------------------------------------|--------------------------------|
|                                                               |                                               |                              |                                                      | COMPOSITION WORDS<br>PER MIN.                            | REPRODUCTION<br>WORDS PER MIN. |
| 4                                                             | 8.5                                           | 29                           | 11                                                   | 12                                                       | 14                             |
| 5                                                             | 10.0                                          | 32                           | 14                                                   | 14                                                       | 17                             |
| 6                                                             | 11.5                                          | 36                           | 16.5                                                 | 16                                                       | 19                             |
| 7                                                             | 13.0                                          | 40                           | 19                                                   | 17                                                       | 21                             |
| 8                                                             | 14.5                                          | 44                           | 21.5*                                                | 18                                                       | 23                             |
| 9                                                             | 15.0                                          | 50                           | 23                                                   | —                                                        | —                              |
| 10                                                            | 15.3                                          | 56                           | 24                                                   | —                                                        | —                              |
| 11                                                            | 15.7                                          | 61                           | 24.5                                                 | —                                                        | —                              |
| 12                                                            | 16.0                                          | 64                           | 25                                                   | —                                                        | —                              |
| Average<br>Difference<br>Generalized<br>from Actual<br>Scores | .3                                            | 1.6                          | .7                                                   |                                                          |                                |

\*Quality of eighth grade reproduction 43 Hillegas.

†Fourteenth Yearbook, National Society for the Study of Education, p. 56.

This table is to be read as follows: The fourth grade children at Gary wrote compositions at the median rate of 8.5 words per minute. The median quality of these compositions was 29 Hillegas. In reproducing a simple story, the same children wrote at the rate of 11 words per minute. Comparative data from similar, although not exactly comparable, tests gave 12 words per minute for fourth grade composition, and 14 words per minute for fourth grade reproduction.

## THE GARY SCHOOLS

TABLE LV  
 ERRORS IN CAPITALIZATION, PUNCTUATION, AND GRAMMAR IN EIGHTH GRADE COMPOSITIONS—RESULTS  
 BY CLASSES AND SCHOOLS

|           | CLASS | TOTAL<br>ERRORS | NUMBER OF<br>PUPILS<br>MISSING | PER CENT.<br>PUPILS<br>MISSING | AVERAGE<br>ERROR PER<br>PUPIL<br>MISSING | AVERAGE<br>ERROR PER<br>PUPIL IN<br>CLASS |
|-----------|-------|-----------------|--------------------------------|--------------------------------|------------------------------------------|-------------------------------------------|
| Jefferson | 18    | 12              | 6                              | 19                             | 2.0                                      | .38                                       |
|           | 18    | 30              | 14                             | 44                             | 2.1                                      | .9                                        |
|           | 18    | 90              | 23                             | 72                             | 3.9                                      | 2.8                                       |
|           | 18    | 132             | —                              | —                              | —                                        | 4.1                                       |
| Emerson   | 14    | 13              | 4                              | 13                             | 3.2                                      | .4                                        |
|           | 15    | 31              | 12                             | 40                             | 2.6                                      | 1.0                                       |
|           | 14    | 33              | 15                             | 48                             | 2.2                                      | 1.1                                       |
|           | 15    | 75              | 22                             | 73                             | 3.4                                      | 2.5                                       |
|           | 14    | 127             | 30                             | 97                             | 4.2                                      | 4.1                                       |
|           | 15    | 112             | 26                             | 86                             | 4.3                                      | 3.7                                       |
|           | Total | 391             | —                              | —                              | —                                        | 6.4                                       |
| Froebel   | 45    | 26              | 9                              | 69                             | 2.9                                      | 2.0                                       |
|           | 46    | 22              | 6                              | 29                             | 3.7                                      | 1.0                                       |
|           | 45    | 36              | 10                             | 77                             | 3.6                                      | 2.8                                       |
|           | 46    | 50              | 12                             | 57                             | 4.2                                      | 2.4                                       |
|           | 45    | 45              | 12                             | 92                             | 3.3                                      | 3.5                                       |
|           | 46    | 116             | 17                             | 81                             | 6.8                                      | 5.5                                       |

| City | Total          | 296 | —   | —  | —   | 8.7 |
|------|----------------|-----|-----|----|-----|-----|
|      | Capitalization | 104 | 87  | 29 | 2.8 | .8  |
|      | Punctuation    | 224 | 73  | 57 | 3.1 | 1.8 |
|      | Grammar        | 490 | 108 | 85 | 4.5 | 3.9 |
|      | Total          | 818 | —   | —  | —   | 6.4 |

Number of Pupils Tested: Jefferson No. 18 = 32, Emerson No. 14 = 31, Emerson No. 15 = 30  
 Froebel No. 45 = 13, Froebel No. 46 = 21. Total = 127

This table is to be read as follows: Class No. 18 Jefferson made a total of 12 capitalization errors in the eighth grade compositions. These errors were made by 6 pupils, which was 19 per cent. of all the pupils of the class. The average error per pupil missing was 2, or .38 of an error per pupil in class. Comparing this record with similar records for the other eighth grade classes, we find that Emerson No. 14 had practically the same average error, .4 per pupil. Class 15 had nearly three times as many, 1.0 per pupil. Class No. 46 Froebel had the same score as Emerson No. 15, while class No. 45 Froebel had a still larger score of 2 errors on the average per pupil in the class. The relative rank of the schools is, therefore, Jefferson, Froebel, and Emerson. Similar relations hold for the other types of errors, the average number of errors of all types per pupil being in the relation of 4.1: 6.4: 8.7.



228). When it is remembered that the errors selected for scoring include gross errors only, it will be seen that the Gary product in its mechanical aspects is not very satisfactory.

An important phase of school training is the development of an adequate vocabulary. Fifty-three per cent. of the different words and 86 per cent. of the running words used by the eighth grade children in Gary are classified by Jones as second grade words (Table LVI, page 231, Figure 38, page 232). The Gary results include every word used in the 127 eighth grade compositions analyzed, while the Jones vocabulary includes only words used by at least 2 per cent. of the children of a given grade. If the Gary vocabularies had been restricted to different words used at least three times, the percentage of the second grade words would have been seventy-five.<sup>1</sup>

Again a careful study of the vocabulary<sup>2</sup> fails to show any clear effect of the special training at Gary. For instance, the word "carbon" is used three times, but a reading of the composition in which it occurs shows that

<sup>1</sup>Comparative data from conventional schools are not available. However, a tabulation of a random sampling of all the words used in the eighth grade compositions gave 54 per cent. of the words five letters or less in length. A similar random sampling of Jones' second grade words gave 45 per cent. five letters or less in length. That is, the Gary vocabulary contained a larger proportion of the simpler, smaller words. See also page 414.

<sup>2</sup>In Appendix A, VII, page 434, will be found a list of all the eighth grade words which are not either proper nouns, words in Jones' List, or derivations of those words. That is, it contains all words which might in any way be peculiar to Gary.

TABLE LVI  
SUMMARY OF WORDS USED IN COMPOSITIONS BY EIGHTH GRADE CHILDREN AT GARY<sup>1</sup>

| GRADE<br>ACCORDING<br>TO JONES | NUMBER<br>OF<br>DIFFERENT<br>WORDS | PER CENT.<br>EACH GRADE<br>IS OF TOTAL | PER CENT.<br>EACH GRADE<br>VOCABULARY<br>ACCORDING<br>TO JONES | GRADE<br>ACCORDING<br>TO JONES | FREQUENCY.<br>NO. OF<br>RUNNING<br>WORDS | PER CENT.<br>EACH GRADE<br>GROUP IS<br>OF TOTAL |
|--------------------------------|------------------------------------|----------------------------------------|----------------------------------------------------------------|--------------------------------|------------------------------------------|-------------------------------------------------|
| 2                              | 1,339                              | 53                                     | 48                                                             | 2                              | 23,807                                   | 86.2                                            |
| 3                              | 180                                | 7                                      | 10                                                             | 3                              | 682                                      | 2.5                                             |
| 4                              | 148                                | 6                                      | 10                                                             | 4                              | 373                                      | 1.3                                             |
| 5                              | 93                                 | 4                                      | 10                                                             | 5                              | 210                                      | .8                                              |
| 6                              | 88                                 | 4                                      | 9                                                              | 6                              | 188                                      | .7                                              |
| 7                              | 81                                 | 3                                      | 9                                                              | 7                              | 309                                      | 1.1                                             |
| 8                              | 51                                 | 2                                      | 9                                                              | 8                              | 74                                       | .3                                              |
| N. L.                          | 386                                | 15                                     |                                                                | N. L.                          | 715                                      | 2.6                                             |
| Discarded                      | 140                                | 6                                      |                                                                | Discarded                      | 1,252                                    | 4.5                                             |
| Total                          | 2,506                              | 100                                    |                                                                | Total                          | 27,610                                   | 100                                             |

<sup>1</sup> Analysis is based on Jones' vocabulary. Not all the words listed by Jones as second grade words are short words, but on the other hand the proportion of words of five letters or less was greater in the Gary vocabularies than in Jones'.

This table is to be read as follows: The eighth grade children at Gary used a total of 27,610 running words, or 2,506 different words. Of these, 1,339 different words, or 53 per cent., were second grade words according to Jones. The second grade words are, in general, 43 per cent. of the total vocabulary according to Jones. The 1,339 different words were used a total of 23,807 times. That is, 86.2 per cent. of all the running words were of second grade difficulty.

N.L. means not listed, or words used by the Gary children and not given by Jones.

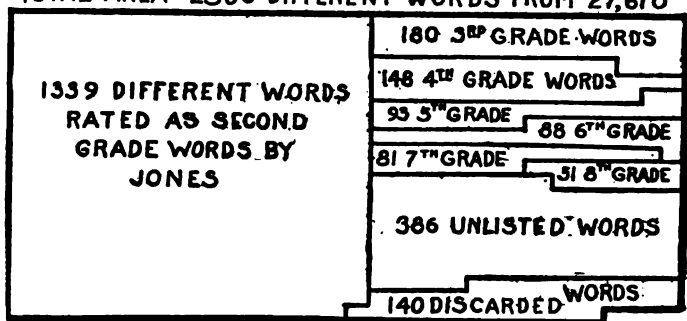
Discarded means derivatives, prepositions, etc., not listed by Jones.

the word was acquired at the time the boy was in a booth with his brother, a moving-picture operator. ("The red hot carbon fell out of the lantern and set fire to the film.") Similarly, in one case, "auditorium" refers

FIGURE 38

VOCABULARY OF EIGHTH GRADE COMPOSITIONS BASED ON JONES'  
VOCABULARY LISTS

VOCABULARY - EIGHTH GRADE COMPOSITIONS  
TOTAL AREA = 2506 DIFFERENT WORDS FROM 27,610



not to school work, but to the name of a theatre in Chicago; "pottery" to Indian pottery seen on a trip to New Mexico. One of the few possible exceptions is a set of words, "mummy, art, beetles," etc., which are used in describing a trip to the Art Museum in Chicago. The trip was taken with nine other boys from Gary and may have grown out of school work, although no reference is made to teacher or school. As far as it is possible to judge, the various words which do not appear in Jones

TABLE LVII  
COMPOSITION SUBJECTS—EIGHTH GRADE CLASSES

|                                                                       |     |
|-----------------------------------------------------------------------|-----|
| Total number of papers.....                                           | 127 |
| ANALYSIS A                                                            |     |
| RELATIVE TO LIFE OF CHILD                                             |     |
| Events in the life of the writer (exciting).....                      | 49  |
| Descriptions of scenes or accounts of experiences (not exciting) ..   | 30  |
| Accounts of incidents observed in the life of others (exciting) . . . | 19  |
| Description of trips.....                                             | 13  |
| Accounts of experiences related by others (not seen).....             | 11  |
| Dreams, ghost stories, and imaginary events.....                      | 4   |
| Experiment in physics.....                                            | 1   |
| Total                                                                 | 127 |
| ANALYSIS B                                                            |     |
| TYPES OF EXPERIENCES                                                  |     |
| Accidents, runaways, and collisions.....                              | 23  |
| Experiences, fishing, swimming, walking, and skating.....             | 22  |
| Trips.....                                                            | 20  |
| By boat 10                                                            |     |
| " rail 6                                                              |     |
| " auto 4                                                              |     |
| Hikes in woods or country.....                                        | 12  |
| Storms.....                                                           | 18  |
| Rain 11                                                               |     |
| Snow 5                                                                |     |
| Hail 2                                                                |     |
| Fires.....                                                            | 6   |
| Errands.....                                                          | 5   |
| Miscellaneous.....                                                    | 21  |
|                                                                       | 127 |
| ANALYSIS C                                                            |     |
| SOURCE                                                                |     |
| Farm, country, or woods.....                                          | 30  |
| City.....                                                             | 24  |
| Rivers, lakes, or ocean.....                                          | 23  |
| A trip of some kind.....                                              | 15  |
| Home.....                                                             | 12  |
| School.....                                                           | 7   |
| On way home after school.....                                         | 7   |
| Miscellaneous.....                                                    | 9   |
|                                                                       | 127 |

may as well have been acquired from actual life experiences as from school activities.

The incidents chosen as subjects by the 127 children tested in the eighth grade classes were carefully studied and tabulated (Table LVII, page 233). The children followed instructions and wrote, for the most part, about simple, childish interests in striking occurrences of daily life. There is little in them to show that the interpretation placed upon these experiences by the children has been influenced in any way by school training.

#### SCHOOL TO SCHOOL COMPARISON

In making comparisons from school to school, marked differences were found. Of the 13 classes tested in the Jefferson School 2 had composition scores markedly above the city scores and one below. Of the 12 classes in the Beveridge School none was above the city score and 7 below (Table LVIII, page 235). Comparisons on the basis of composition rate, or rate of reproduction, yield results which are very similar. The schools in order of rank are: Jefferson, Emerson, Froebel, and Beveridge. It is probable, however, that these differences are not in any way due to special program features. If the differences observed were due to the enriched curriculum, the order of schools would probably be: Emerson, Froebel, Jefferson, and Beveridge; Froebel being put second instead of first to allow for the difficulty in language work with the children of foreign born parents. Under the circumstances, the differences shown

TABLE LVIII  
SCHOOL TO SCHOOL COMPARISON<sup>1</sup>

| SCHOOL             | COMPOSITION RATE |       |       | COMPOSITION QUALITY |       |       | REPRODUCTION RATE |       |       |
|--------------------|------------------|-------|-------|---------------------|-------|-------|-------------------|-------|-------|
|                    | CLASSES TESTED   | ABOVE | BELOW | CLASSES TESTED      | ABOVE | BELOW | CLASSES TESTED    | ABOVE | BELOW |
| Froebel. . . . .   | 22               | 6     | 5     | 22                  | 2     | 8     | 22                | 6     | 2     |
| Emerson. . . . .   | 11               | 4     | 2     | 11                  | 1     | 0     | 11                | 0     | 1     |
| Jefferson. . . . . | 13               | 6     | 2     | 13                  | 2     | 1     | 13                | 3     | 1     |
| Beveridge. . . . . | 12               | 1     | 10    | 12                  | 0     | 7     | 12                | 1     | 7     |

<sup>1</sup>Summary of the number and character of deviations which exceed one tenth the generalized city scores.

This table is to be read as follows: Of 22 classes measured as to rate of writing an original composition, 6 had scores markedly above the city score for the grade, and 5 were markedly below. In quality of composition, 2 were above the city scores and 8 below. In rate of reproducing a story, 6 were above the city score and 2 below.

in the table are probably not significant from the point of view of this investigation.

## COMPARATIVE DATA

The question of the value of the Gary product as compared with similar work in other schools cannot be set-

TABLE LIX  
COMPARATIVE DATA FOR QUALITY OF COMPOSITION (HILLEGAS)\*

| Grade | Gary | Trabue<br>Standard | Starch's<br>Standard | Butte | Salt Lake<br>City | Nassau<br>County,<br>N. Y. | Mobile,<br>Ala. | Mobile<br>County,<br>Ala. | South<br>River, N. J. | Chatham,<br>N. J. | Detroit                       |
|-------|------|--------------------|----------------------|-------|-------------------|----------------------------|-----------------|---------------------------|-----------------------|-------------------|-------------------------------|
| 4     | 29.9 | 35                 | 26                   | 23    | 29*               | 28                         | 33              | 32                        | 23                    | 29                |                               |
| 5     | 32.6 | 40                 | 31                   | 28    | 31*               | 34                         | 38              | 39                        | 26                    | 28                |                               |
| 6     | 32.8 | 45                 | 36                   | 34    | 38*               | 38                         | 46              | 43                        | 38                    | 41                | 47                            |
| 7     | 39.7 | 50                 | 41                   | 38    | 44*               | 42                         | 50              | 42                        | 48                    | 40                |                               |
| 8     | 45.8 | 55                 | 46                   | 41    | 54*               | 46                         |                 |                           | 56                    | 53                |                               |
| 9     | 46.9 | 60                 |                      |       |                   | 50                         |                 | 56                        | 52                    |                   |                               |
| 10    | 56.2 | 65                 |                      |       |                   | 53                         | 67              | 64                        | 50                    |                   |                               |
| 11    | 64.2 | 69                 |                      |       |                   | 57                         | 72              | 60                        | 59                    |                   |                               |
| 12    | 62.2 | 72                 |                      |       |                   | 59                         | 75              | 68                        | 63                    |                   |                               |
|       |      |                    |                      |       |                   |                            |                 |                           |                       |                   | Fifty four<br>High<br>Schools |
|       |      |                    |                      |       |                   |                            |                 |                           |                       |                   | 50                            |
|       |      |                    |                      |       |                   |                            |                 |                           |                       |                   | 59                            |
|       |      |                    |                      |       |                   |                            |                 |                           |                       |                   | 64                            |
|       |      |                    |                      |       |                   |                            |                 |                           |                       |                   | 67                            |

\*See page 38.

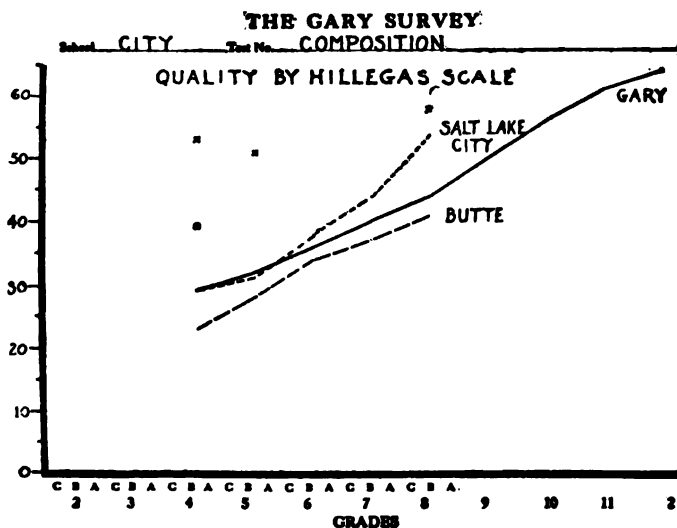
\*Starch's standards are derived from Butte and Salt Lake City.

\*The values of this column are those printed in the Salt Lake City Survey Report. It is probable, however, that to make these values comparable with Gary they should be raised 7 points as they were computed in a peculiar manner. See page 247.

This table should be read as follows: The median fourth grade score in quality of composition at Gary was 29.9 Hillegas. Trabue's fourth grade standard, 35; Starch standard, 26; fourth grade score at Butte, 23; Salt Lake City, 29; Nassau County, 28; Mobile, Alabama, 33; Mobile County, 32; South River, N. J., 23; Chatham, N. J., 29.

The scores of the eighth grade classes were as follows: Froebel, class 45, 40 Hillegas; class 46, 40. Emerson, class 14, 47.2; class 15, 44.0. Jefferson, class 18, 50.

FIGURE 39  
COMPARATIVE DEVELOPMENT



The scale along the bottom of the figure represents grades, the scale along the vertical axis represents quality by the Hillegas Scale. The solid line represents Gary; broken line, Butte; dotted line, Salt Lake City.

The Gary results are better than those from Butte and not so good as those from Salt Lake City. The Gary and Salt Lake City curves are the same to the fifth grade, but the value of the scores in Salt Lake City increases more rapidly than in Gary, so that by the eighth grade the Gary scores are about two years behind. Note the increased rate of growth in the high school grades. For comments on the reliability of scoring by the Hillegas Scale see Section 2 of this Chapter, page 239.



tled as definitely as for other subjects, because few comparative data are available, and studies of the reliability of scoring by the Hillegas Scale are conflicting. The Gary eighth grade score (45.8 Hillegas) is higher than the corresponding Butte score (41 Hillegas) and lower than those given in the Salt Lake City Survey (54 Hillegas) (Table LIX, page 236, Figure 39, page 237).

In making the Denver and Grand Rapids surveys the Willing Composition Scale was used. The values of this scale do not correspond to those of the Hillegas Scale, but through the kindness of Mr. Willing all but one of the eighth grade classes<sup>1</sup> were scored by him personally, so that the Gary results might be directly comparable with the Denver and Grand Rapids scores. The median quality of the Denver eighth grade papers, written on the same subject and under the same conditions as the Gary papers, was 63.5; of the Grand Rapids papers, 65.0; of the Gary papers scored by Mr. Willing, 61.3.<sup>2</sup>

It is extremely probable, therefore, that on the basis of such comparative data as are available at present they should be judged to be about equal to the products of composition training in conventional schools.<sup>3</sup>

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<sup>1</sup>The fifth one was omitted because of lack of time.

<sup>2</sup>The median of the Hillegas scores of the same 97 papers by the Gary judges was 46.3 as compared with 45.8 for the entire grade, so the omission of the one class did not greatly influence the result.

<sup>3</sup>The personal judgment of the author is that this conclusion will not stand when more comprehensive comparative data are available.

## §2. CRITICAL DISCUSSION

The measurement of ability in English composition presents a problem of greater difficulty than the measurement of any of the abilities previously discussed. The factors which determine the merit of a composition and those which affect the judgment of the scorer are many. Little is known about their relative value. The ordinary marking of teachers varies enormously, both from teacher to teacher, or for any one teacher from day to day, and from sample to sample. Also the use of a composition scale has been attacked by certain teachers of English. It is important, therefore, that the method of marking the papers from the composition test in the survey be explained in detail.

## SCALE USED

All marks reported are in terms of the Hillegas Scale.<sup>1</sup> Unfortunately, the purpose and value of the scale have been so little understood that the use of the scale for survey purposes must be justified. It must be admitted at once that the scale cannot be used effectively without training. The effects of a first reading of the scale are likely to be irritation and a sense of the impossibility of attempting to judge of the quality of a composition by reference to other compositions of a totally different character. Yet it is easy to show that such judgments are not only possible, but are accurately and consistently

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<sup>1</sup>Teachers College Record, Vol. 13, No. 4, page 21.

made, once certain viewpoints and experiences are gained.

The Hillegas Scale provides for marking of compositions on an absolute basis. That is, a mark given by the scale means just one thing, the degree of merit possessed by the composition as a composition, and entirely apart from any consideration of the age or grade of the author, the conditions under which it was written, or the purpose for which the mark is given. That is, 50 Hillegas units of composition are comparable in meaning to 50 inches or units of length, 50 pounds or units of weight, or 50 units of any other quantity which may be measured in absolute terms.

The reader unfamiliar with the use of scientific units for the measurement of educational products should see that the composition scale has for one of its purposes the bringing to light of the very items which teachers' marks conceal. The teacher of a fourth grade class recognizes a paper as an exceptional paper for the grade and marks it, let us say, 95 per cent. The teacher of the eighth grade class also assigns a mark of 95 per cent. to a paper from her class. Numerically, the two papers are equal; yet both teachers would agree that one paper is better than the other. The marks have served the teacher's purpose, but from the point of view of a survey they conceal the most important elements that the survey wishes to reveal, i.e., the real quality of the compositions and the amount of progress which has been made from the fourth to the eighth grades. If, however, the two

papers are marked in terms of the scale and one is found to be of quality 40, while the other is of quality 80, it is possible to say at once that the one has twice as much merit as the other.

Many persons will admit the desirability of absolute marking, but do not believe that the scale can be used for such a purpose. It is easy to prove, however, that everyone recognizes gross differences in general merit. If the reader will scan, superficially or carefully, the two samples below (taken from the papers written at Gary) he will have no difficulty in recognizing that as samples of English composition one represents a more advanced stage of development than the other.

#### SAMPLE 1

"One the day I was on a wonderful jourray. I travelled in the mountains and as I travelled about Two days and accident happen to me because I slipped of the rock and hurt my foot. And so I went on, and seen a bear behind me and I started to run away. And as I ren I fell into the water and then the bear disappeared. And so I went home very lately.

"Next morning I was traveling in the different parts. When I was about in the middle of the forest"

#### SAMPLE 2

"Ice," called George, a jolly, big, fat negro as he entered the yard with his wagon and mules. Today the ice wagon, however, was to be the conveyance for a picnic party and they were to traverse the beautiful

solitary roads in the mountains of North Carolina. There was a grand scramble, the picnics climbed in, seated themselves on the hay, laughing and talking until the gloominess of the woods and the stony, so-called roads attracted their entire attention."

These two samples, however, constitute a rough scale by which any other samples may be measured; for if one reads Sample 3 (below) he will have no difficulty in recognizing that it is intermediate in value between the other two.

#### SAMPLE 3

"This is a real experience. It happened at Miller's beach in the summer of 1913.

"My brother, another young man, and myself went out in a row boat.

"When we had gotten about half a mile from the shore my brother dived off of the boat. He came up once and went down again, he came up again and went down again he came up again and went down again. We waited awhile but he did not come up.

"Our friend dived off after him and after some difficulty located him.

"He brought him up out of the water and after they had struggled awhile knocked him senseless."

Suppose that more and more samples were thus read and assigned a place in relation to the samples previously read. It is evident that the time would come when the difference from sample to sample would be so slight that

it would be difficult to make judgments with certainty, just as it is impossible to tell with the eye alone whether a given bar is 3.65 inches long or 3.66 inches. The series of samples as a whole would give an illustration of every type of sample from the worst to the best.

The Hillegas Scale provides a series of selected samples whose values have been determined by a statistical procedure which enables the results to be expressed in units according to a consistent plan. The scorer may compare a given specimen with the scale and determine its value from the values of the scale samples between which it is judged to fall, and this can be done accurately and consistently.<sup>1</sup>

#### ANALYSIS OF SCALE

This, however, is the point at which many stumble, for misunderstanding easily arises. Many see in the scale only a series of distinct compositions differing in content and style. They do not generalize from these compositions and carry in mind a general concept of "progress-in-English-composition-as-a-whole" of which the samples are merely particular illustrations. Yet the fact of such progress is self-evident. The average child entering the first grade cannot express his thoughts in writing, and, naturally, when he begins to do so, his attempts are very imperfect. After twelve years of

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<sup>1</sup>Values of the samples above in terms of Hillegas Scale: Sample 1, one judge, 35. Sample 2, average of two judgments, 75. Sample 3, median of five judgments, 48. Average deviation 2.6.

training, however, a high level of ability may be reached, and the progress from the lower to the higher level follows certain general tendencies which are represented objectively in the samples of the scale. It becomes important, therefore, to express these gradations of development in their generalized form and to use the samples of the scale only as an aid to judgment in determining the precise value to be assigned a given composition.

The writer's generalization of the Hillegas Scale is as follows: The development of ability in English composition passes through three phases. At first there is the struggle to master the mere mechanics of expression, the spelling of words and their arrangement in the conventional order. Then follows a second stage in which the efforts of the person writing are expended mainly upon organization of subject matter, the selection of the details to be expressed and their organization into connected discourse. Finally there is the stage of development of literary merit in which choice of words, and the selection and organization of subject matter cease to be mechanical and become artistic (Figure 40, page 245). Of course, no hard and fast lines can be drawn between one phase of ability and another, but the main characteristics of each of the three stages of development are well marked and serve to fix the limits of value within which a given composition must fall. In Appendix A will be found illustrations of samples of each type, chosen from the Gary compositions on the basis of the judgments of

the Gary judges. Reference to this series of samples (which in themselves constitute a composition scale) will enable any reader to determine for himself exactly what a composition of a given value is like.

FIGURE 40  
ANALYSIS OF THE HILLEGAS COMPOSITION SCALE

| <i>A. Mechanics</i><br>(Difficult to Read)                   | <i>B. Organization</i><br>(Tiresome to Read)                                | <i>C. Literary Merit</i><br>(Interesting to Read)                        |
|--------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 0-9<br>Meaning uncertain<br>after study.                     | 30-39<br>Mere succession of<br>sentences loosely<br>joined.                 | 70-79<br>Interesting material<br>marred by imperfect<br>choice of words. |
| 10-19<br>Meaning decipher-<br>able but with dif-<br>ficulty. | 40-49<br>Disconnected sen-<br>tences with much<br>irrelevant matter.        | 80-89<br>Well selected material<br>expressed in well<br>chosen words.    |
| 20-29<br>Meaning not ap-<br>parent on first<br>reading.      | 50-59<br>Connected sentences:<br>Few mistakes, unin-<br>teresting material. | 90-99<br>Exceptional content<br>and quality.                             |
|                                                              | 60-69<br>Well organized, but<br>common place in<br>content.                 |                                                                          |

This analysis should be read as follows: If a composition because of its gross errors in mechanics proves difficult to read and understand, it falls in the first division of the scale (0-30). If the meaning is not clear after repeated attempts to decipher the composition, the value assigned it should be between 0 and 9 points, depending on the amount which can be read. If the meaning is decipherable, but with difficulty, its quality should be rated from 10 to 19 points, and so on.



## TRAINING OF SCORERS

The five judges who scored the eighth grade samples at Gary had had some experience in the use of the scale, but only one (the writer) was convinced that scoring by means of a scale yields constant and reliable results. Accordingly, the first work of scoring was the training of these judges in the use of the scale. The samples of the Hillegas Scale were cut apart and given to the scorers, one at a time, to be arranged in order of merit, as was illustrated in the case of samples 1, 2, and 3, pages 241 and 242. The differences between the first samples given out for comparison were made very large in order that the judgments of the scorers might agree. This established the fact that the judges were able to recognize gross differences in merit. Little by little, however, the amount of difference from sample to sample was decreased until the limits of discrimination of the judges was reached. A discussion of the reasons for the relative positions assigned the samples by each judge, and of the characteristics of the samples themselves, then followed until some agreement had been reached as to the basis on which judgment was to be made. Finally, a certain amount of practice scoring was done on samples whose values are known, using those given in the Butte and other surveys, and in the articles on measurement of English composition which have been published from time to time.<sup>1</sup> In this way the basis of making judgments was soon standardized.

<sup>1</sup>At this time the standard samples issued by Professor Thorndike were not available.

## SCORING OF PAPERS

When it had been determined that the judges could use the scale consistently, the scoring of the Gary compositions began. The eighth grade papers were scored by all the judges, but two judges did most of the scoring of the papers of other grades, each class being scored by a single judge. At intervals, however, these judges re-scored certain classes to make sure their standards were not changing. Also, as early as possible a set of compositions (mainly those given in V, Appendix A) was chosen from the Gary papers to form the Gary scale, and in cases of doubt papers were referred to both the Gary Scale and the Hillegas Scale. Most of the judges, however, preferred to use the Hillegas Scale rather than the scale of uniform material derived from it.

Each paper was assigned the mark which expressed the judgment of the scorer as to its true value, as 37, 39, 43, etc. In this respect the practice at Gary differed from that sometimes followed of giving each paper the value of the scale sample it most resembled. Thus in the Butte survey, compositions were marked at "0, 1, 2, etc., according to which one of the printed compositions they thought it most like." A similar practice was followed in the Salt Lake City survey.

## RELIABILITY OF SCORING

A study was made of the variations in judgments in scoring the eighth grade samples. For instance, in one

TABLE LX  
SCORES OF AN EIGHTE GRADE CLASS BY FIVE JUDGES SCORING INDEPENDENTLY

| PAPER<br>No. | QUALITY ACCORDING TO JUDGE |    |    |    |    | MEDIAN<br>QUALITY | DEVIATION OF EACH JUDGE |     |     |    |    | TOTAL | AVERAGE |
|--------------|----------------------------|----|----|----|----|-------------------|-------------------------|-----|-----|----|----|-------|---------|
|              |                            |    |    |    |    |                   |                         |     |     |    |    |       |         |
|              | A                          | B  | C  | D  | E  |                   | A                       | B   | C   | D  | E  |       |         |
| 1            | 35                         | 30 | 25 | 26 | 36 | 30                | +5                      | -5  | -1  | +6 | 20 | 4.0   |         |
| 2            | 40                         | 30 | 25 | 35 | 43 | 35                | +10                     | -5  | -13 | +5 | 23 | 4.6   |         |
| 3            | 45                         | 35 | 25 | 35 | 40 | 35                | 0                       | -5  | +13 | 0  | 24 | 4.8   |         |
| 4            | 35                         | 35 | 48 | 35 | 40 | 37                | 0                       | -7  | +3  | 0  | 23 | 4.6   |         |
| 5            | 45                         | 35 | 32 | 45 | 36 | 37                | +12                     | -7  | -1  | 0  | 19 | 3.8   |         |
| 6            | 50                         | 40 | 35 | 35 | 38 | 38                | +5                      | -2  | +3  | 0  | 20 | 4.0   |         |
| 7            | 45                         | 30 | 30 | 35 | 43 | 33                | +10                     | -7  | 0   | 0  | 17 | 3.4   |         |
| 8            | 45                         | 40 | 38 | 32 | 40 | 39                | +10                     | +3  | -5  | -1 | 17 | 3.4   |         |
| 9            | 50                         | 40 | 35 | 40 | 38 | 40                | +10                     | 0   | -5  | 0  | 17 | 3.4   |         |
| 10           | 50                         | 40 | 45 | 35 | 40 | 40                | 0                       | 0   | -5  | -1 | 13 | 2.6   |         |
| 11           | 45                         | 40 | 40 | 40 | 43 | 40                | 0                       | 0   | -5  | 0  | 19 | 3.8   |         |
| 12           | 45                         | 40 | 40 | 45 | 36 | 40                | +10                     | 0   | 0   | 0  | 13 | 2.6   |         |
| 13           | 50                         | 35 | 40 | 35 | 40 | 40                | +10                     | 0   | 0   | 0  | 26 | 5.2   |         |
| 14           | 40                         | 40 | 48 | 40 | 40 | 40                | 0                       | -10 | +8  | 0  | 18 | 3.6   |         |
| 15           | 50                         | 30 | 48 | 40 | 40 | 40                | +10                     | -10 | +9  | 0  | 28 | 5.6   |         |
| 16           | 50                         | 30 | 50 | 35 | 45 | 40                | 0                       | -10 | 0   | 0  | 16 | 3.2   |         |
| 17           | 40                         | 35 | 45 | 37 | 43 | 43                | 0                       | -5  | -3  | 0  | 30 | 6.0   |         |
| 18           | 40                         | 45 | 37 | 37 | 43 | 42                | 0                       | +3  | -1  | 0  | 22 | 4.4   |         |
| 19           | 50                         | 35 | 37 | 37 | 43 | 42                | +5                      | -5  | 0   | 0  | 17 | 3.4   |         |
| 20           | 45                         | 40 | 47 | 55 | 45 | 45                | 0                       | -1  | -12 | 0  | 15 | 3.0   |         |
| 21           | 50                         | 40 | 50 | 50 | 47 | 50                | +5                      | -1  | 0   | 0  | 25 | 5.0   |         |
| 22           | 50                         | 35 | 50 | 50 | 43 | 50                | +5                      | -14 | +10 | 0  | 26 | 5.2   |         |
| 23           | 50                         | 35 | 50 | 45 | 45 | 50                | +5                      | -1  | 0   | 0  | 25 | 5.0   |         |
| 24           | 50                         | 50 | 50 | 50 | 45 | 50                | +5                      | -1  | 0   | 0  | 25 | 5.0   |         |
| 25           | 50                         | 50 | 50 | 50 | 45 | 50                | +5                      | -1  | 0   | 0  | 25 | 5.0   |         |
| 26           | 50                         | 50 | 50 | 50 | 45 | 50                | +5                      | -1  | 0   | 0  | 25 | 5.0   |         |
| 27           | 50                         | 50 | 50 | 50 | 45 | 50                | +5                      | -1  | 0   | 0  | 25 | 5.0   |         |
| 28           | 50                         | 50 | 50 | 50 | 45 | 50                | +5                      | -1  | 0   | 0  | 25 | 5.0   |         |
| 29           | 50                         | 50 | 50 | 50 | 45 | 50                | +5                      | -1  | 0   | 0  | 25 | 5.0   |         |
| 30           | 50                         | 50 | 50 | 50 | 45 | 50                | +5                      | -1  | 0   | 0  | 25 | 5.0   |         |



FIGURE 41  
VARIATIONS IN QUALITY—BASED ON TABLE LX

ENGLISH COMPOSITION - VARIATION IN SCORING

QUALITY-HILLEGAS

0 20 40 60

DEVIATIONS FROM MEDIAN

+10 +5 +1 0 -1 -5 -10 -15

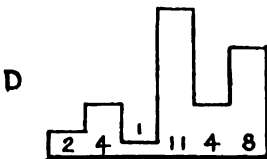
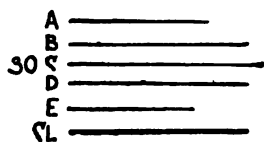
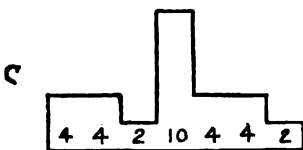
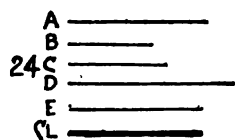
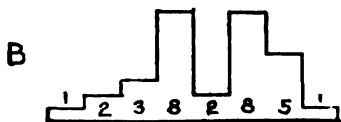
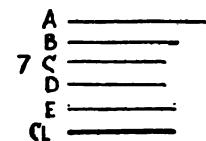
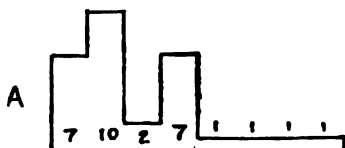
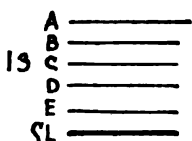
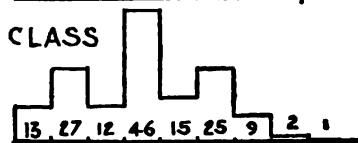
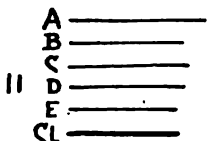


FIGURE 41—*Continued*

The diagrams at the left hand side of the figure represent individual papers. The numbers 11, 13, 7, 24, and 30 refer to the numbers of the papers in Table LX. Letters A, B, C, and D, refer to the different judges. Class indicates values for class as a whole. Each light line in the diagram represents the value assigned the sample by one judge. Each heavy line represents the value adopted as the true value of the sample. The scale along the top of the figure represents quality on the Hillegas Scale. The diagram shows that for the class as a whole the class scores as determined from the scores from each judge, except A, agree closely with the value as determined from the combined score of the five independent judgments.

The diagrams marked 11 and 13 represent the scores of samples upon which there was close agreement between the five judges. Paper 7 represents the scores for a sample in which Judge A alone showed a wide variation. Papers 24 and 30 represent samples upon which there was little agreement between the different judges.

The diagrams on the right hand side of the figure show the distribution of the deviations from the score adopted as the true value of the samples. The scale at the top shows the magnitude and quality of the deviations. Figures written in the diagram just above the base line show for each distribution the number of variations of a given type. The diagram for Judge A is to be read as follows:

Out of 30 papers Judge A gave 6 scores which were from 10 to 14 points larger than the real value of the paper, 11 scores from which were from 5 to 9 points higher, 10 scores which were from exactly the same or within 4 points higher or lower, and 1 score each of value 5 to 9, 10 to 14, or 15 to 19 points lower than the score adopted as the true value. Note that Judge A has a tendency to score papers too high, while Judge B has a tendency to score papers too low. Note also that in the distribution of the class as a whole the distribution is symmetrical about the zero point, and that out of 150 deviations 73 are less than 5 points.

eighth grade class (Table LX, page 248, Figure 41, page 250), while individual judges differ widely on certain samples (see numbers 3, 24, 29, and 30), yet the scores as a whole show close agreement. Of the 150 individual ratings given by the five judges on the thirty papers of this class, 46, or 31 per cent., agree exactly with the median score; 56 more, or 37 per cent., do not differ more than 5 points, or half a step of the scale; and only 10, or 7 per cent., of the judgments differ more than one step from the median values. Fifty two deviations are positive, and 52 negative; that is, variations are as likely to be toward high scores as toward low, and in a large number of scorings cancel each other.

The effect of this neutralization of errors is seen in the class scores. The actual median score of the class as a whole, as determined by the scores of each of the five judges, is practically the same as the class score as determined from the combined scores of the judges (40). For three of the judges, the values are identical (40). The other two judges differ less than one step of the scale (Judge A, 47.5, Judge E, 41.5). Even if the computed medians are used, the differences in no case amount to more than one step of the scale. That is, the score of the class determined by the scores of a single judge are not likely to vary at most more than 10 points from the true value.

The average deviation for all samples and judges is 4.5 points. For individual judges, the values range from 5.8 points to 3.6 points. Therefore, the uncer-

tainty of the scoring by means of the scale amounts, on the average, to about half a step.

This conclusion is borne out by the combined results for the 127 eighth grade papers. The average deviation of 635 judgments was 5.5 points (median 5.3). Thirty per cent. of all the judgments agreed exactly with the combined scores, while 18 per cent. additional fell within 5 points. Seventy five per cent. of all the deviations were less than 10 points.

The agreement of the median class scores as determined from the scores of each judge with the class score determined from the combined judgments is close. In three cases only (Judge A) are they larger than 10. Excluding Judge A, the average is 3.5 points. For Judge A the average is 10.5 points. Therefore, the classes were scored consistently and the results may be taken as correct within 10 points. The chances are about even that a re-scoring of the papers by a different set of trained judges would yield the same results as those given in the tables within 5 points.

The different judges proved to have persistent biases. Judge A, for instance, had a tendency to overestimate the quality of a paper, while Judge B underestimated values. These personal biases persist through long periods and may be determined and allowed for. As the eighth grade scores are the median of the five judgments, the bias of Judge A toward high ratings does not affect the results greatly. All other grades except the eighth were scored by Judges C and D. The differences of the class scores of



the five eighth grade classes as determined by the scorings of each of these judges from the same scores based upon the combined judgments of the five judges were, for Judge C, 0, 5, 0, 3, 5, 7 (average 3 points); for Judge D, 7, 4, 0, 5, 1 (average 3.4 points). The scores from grade to grade are, therefore, consistent and comparable within the limit of errors noted.

#### METHOD OF TABULATION

In the tabulation of results the composition scores were grouped by tens. That is, the number of papers having a score in the 30's was recorded as one frequency, all the 40's as another, and so on. In the Butte survey, however, the frequencies based upon the Hillegas sample values were recorded for scores 30, 40, 50, 60, etc. That is, a group of scores extending from 31 to 42 and centering at 36.9 was recorded as if extending from 30 to 40 centering at 35. The medians are, however, correctly figured from the beginnings of the steps, and that the method distorts the results is due wholly to the fact that the values of the samples in the scale are 18, 26, 37, etc., instead of 15, 25, 35. In the Salt Lake City survey the same practice was followed, and, in addition, in computing medians 30 was taken as meaning values from 25 to 35. The effect of this is to lower all medians approximately 7 points from the actual value of the median paper. For instance, class No. 14 Emerson (eighth grade) made a median score of 47 Hillegas as determined by the Gary procedure. According to the Butte meth-

ods the score would have been 46.8, according to the Salt Lake City methods 38. The actual median score was 45. The Gary class scores may, therefore, be from 2 to 9 points higher than they would have been if a different method of tabulation had been followed. The writer believes, however, that the method used in this survey reveals more precisely the true value of the class product.

The practice in other surveys is not known. In view of the possibilities of such differences, as well as the uncertainty in regard to standards adopted in scoring, little reliance can be placed upon comparative data. The reader should study the illustrative samples given and interpret the Gary results in the light of these samples. The use of a scale has at least served to standardize the scoring of the Gary judges and to permit the presentation of results in terms which are not ambiguous in meaning.

#### ERRORS IN PUNCTUATION AND GRAMMAR

The great difficulty in scoring papers for errors in punctuation and grammar is the lack of a standard basis for determining errors. The rules of punctuation are not absolute, and the constructions to be counted as errors in syntax vary greatly with different examiners. Further, comparative data are lacking, so that the results have little significance. It is not enough to know that a child makes a number of errors in grammar. We must know also whether the number of errors is greater or less than the errors made by the average child of the same grade.

## THE GARY SCHOOLS

TABLE LXI  
 SAMPLE TABULATION OF ERRORS IN CAPITALIZATION, PUNCTUATION, AND GRAMMAR<sup>1</sup>

|                | ERROR<br>NO. | JUDGE | PUPIL NUMBER |   |   |   |   |    |   |   |   |    |    |    |    | TOTAL |
|----------------|--------------|-------|--------------|---|---|---|---|----|---|---|---|----|----|----|----|-------|
|                |              |       | 1            | 2 | 3 | 4 | 5 | 6  | 7 | 8 | 9 | 10 | 11 | 12 | 13 |       |
| Capitalization | 1            | A     | —            | 5 | — | 2 | — | 2  | — | 1 | — | 1  | —  | 1  | —  | 12    |
|                | 1            | B     | —            | 4 | — | — | — | 2  | — | — | — | 2  | —  | 2  | —  | 8     |
|                | 2            | A     | —            | — | — | — | — | 2  | — | — | — | —  | —  | —  | —  | 4     |
|                | 2            | B     | 2            | — | — | — | — | —  | — | — | — | 2  | —  | —  | —  | 2     |
|                | 3            | A     | —            | 1 | — | — | 1 | —  | — | 5 | — | —  | —  | —  | 5  | 15    |
| Average Errors | 3            | B     | 1            | — | — | — | 1 | —  | — | 6 | — | —  | —  | 2  | 1  | 10    |
|                |              |       | 2            | 5 | — | 1 | 1 | 4  | — | 6 | — | 2  | —  | 2  | 3  | 26    |
| Punctuation    | 1            | A     | —            | 2 | 1 | 9 | 3 | 10 | 3 | 3 | 2 | 2  | —  | 5  | 10 | 50    |
|                | 1            | B     | —            | 1 | — | 1 | 2 | 5  | — | 2 | — | —  | —  | —  | 6  | 17    |
|                | 2            | A     | —            | 1 | — | 1 | — | —  | — | — | — | 1  | —  | —  | —  | 3     |
|                | 2            | B     | —            | — | — | — | — | —  | — | — | — | 1  | —  | —  | —  | 1     |
|                | 3            | A     | —            | 1 | — | — | — | —  | — | — | — | —  | —  | —  | —  | 1     |
| Average Errors | 3            | B     | —            | — | — | — | — | —  | — | — | — | —  | —  | —  | —  | 1     |
|                |              |       | —            | 3 | — | 6 | 2 | 8  | 2 | 2 | 1 | 2  | —  | 2  | 8  | 36    |
|                | 1            | A     | —            | — | — | — | — | —  | — | — | — | —  | —  | —  | —  | —     |
|                | 1            | B     | —            | — | — | — | — | —  | — | — | — | —  | —  | —  | —  | —     |
|                | 2            | A     | —            | — | 1 | 4 | — | —  | — | 1 | — | —  | —  | 1  | 8  | 14    |
|                | 2            | B     | 1            | 2 | — | — | 2 | 2  | 1 | — | — | —  | —  | —  | 2  | 10    |
|                | 3            | A     | —            | — | — | — | 3 | —  | 2 | — | — | —  | —  | —  | —  | —     |

[illegible]

<sup>1</sup>Based on scoring by two judges of Class No. 45, eighth grade, Froebel.

This table is to be read as follows: According to Judge A pupil No. 1 made 0 mistakes in capitalization, but according to Judge B he made 2 mistakes of the second type and one of the third type; a total of 3. Accordingly, the paper was counted as having 2 errors in capitalization. No mistakes in punctuation were noted by either judge for this paper. In grammar according to Judge A, the paper contained 5 errors; 2 of type 8 and 3 of type 9. According to Judge B, the paper contained 1 error of type 2, 1 error of type 4, and 1 error of type 8. Accordingly, the paper was given an average of 4 errors in grammar.

In the Willing Composition Scale used in the Denver survey, not only is judgment based on general merit, but the attempt is made to grade the samples on the basis of the frequency of error as well; thus, compositions of quality 20 have, on the average, 30 mistakes in spelling, punctuation, and syntax per 100 words written. By quality 50 the number of mistakes has fallen to 14 and by quality 70 to 8. Unfortunately, however, no statement is made as to the type of mistakes which were counted as errors.

For the Gary work, after a careful study of representative papers, it was decided to limit the scoring to gross errors. For capitalization three mistakes only were counted:

1. Failure to begin a sentence with a capital letter.
2. Failure to capitalize a proper noun.
3. The capitalization of common nouns.

In punctuation, also, only three errors were counted:

1. Failure to place a period at the end of a sentence.
2. Failure to place a question mark at the end of a question.
3. Failure to enclose a direct quotation in quotation marks.

In some cases it was found that where the period had been omitted at the end of a sentence, the following sentence was not commenced with a capital. This was not counted as two errors, but recorded as the "period" error only.

Eight types of errors in syntax were recorded:

1. The use of the wrong case form, as "me and him went."
2. The use of one word in place of another, as "it would of (have) been."
3. Lack of agreement of noun and pronoun, as "the pieces were about the size—and it break."
4. Lack of agreement between subject and verb, as "they was."
5. Use of the wrong tense form, as "seen" for "saw."
6. Use of the double negative.
7. Confusion of dependent and independent clauses, as ". . . away, but worst thing was that there were not light on the streets and no road but a little path through the wood but I dressed up and took my dog and started off we were not far from home when my dog his name was Rover began to chase after I was a fright to go myself and began. . . ."
8. Omission of words essential to the thought, or the addition of irrelevant words, as "began to chase after (a rabbit, omitted) I was a fright to go myself."

A few gross errors were recorded which do not fall under any of the headings given above, but their number was so small (8 per cent. of the total) that it has not been thought necessary to list them in detail.

Each paper was scored by two examiners independently. There were marked disagreements between their

TABLE LXII

COEFFICIENTS OF CORRESPONDENCE BETWEEN QUALITY AND A NUMBER OF SPECIFIC CHARACTERISTICS<sup>1</sup>

| TEST                                                      | MEDIAN | MEDIAN DEVIATION | TOTAL RANGE |
|-----------------------------------------------------------|--------|------------------|-------------|
| Quality .....                                             | 43.5   | 4                | 36- 67      |
| Total Length .....                                        | 209    | 54               | 107-426     |
| Different Words .....                                     | 106    | 24.5             | 65-161      |
| Vocabulary Index .....                                    | —      | 2.8              | 35- 62      |
| Spelling Errors (Coefficient) .....                       | 22.5   | 12.5             | 0- 88       |
| Errors in Grammar (Coefficient) .....                     | 22.5   | 15.2             | 0-129       |
| Errors in Spelling and Grammar<br>(Total per paper) ..... | 10.5   | 6.5              | 0-43        |

PERCENTAGE OF TOTAL CASES WHICH DO NOT VARY IN RELATIVE POSITION MORE THAN ONE UNIT OF VARIABILITY, WHERE QUALITY OF COMPOSITION IS COMPARED WITH

| TOTAL NUMBER OF WORDS | NUMBER OF DIFFERENT WORDS | VOCABULARY INDEX | COEFFICIENT OF ERRORS IN SPELLING | COEFFICIENT OF ERRORS IN GRAMMAR | TOTAL MISTAKES PER PAPER |
|-----------------------|---------------------------|------------------|-----------------------------------|----------------------------------|--------------------------|
| 33                    | 33                        | 33<br>16*        | -38<br>-30*                       | -52<br>-44*                      | -48<br>-36*              |

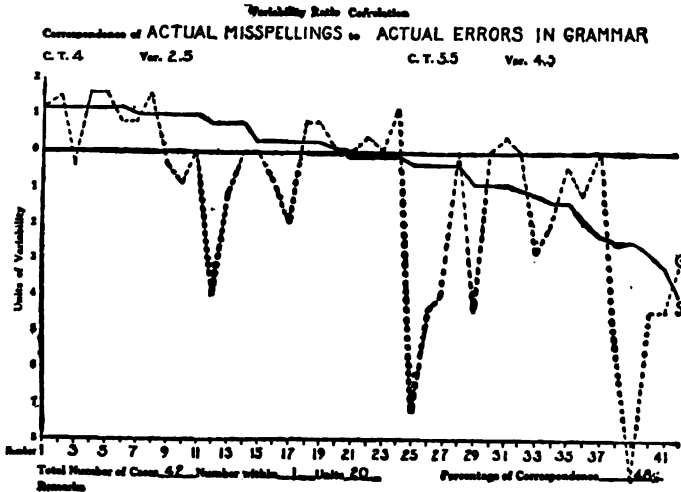
The coefficient of correspondence between errors in spelling and errors in grammar was 48 per cent. (+ .60)\*.

<sup>1</sup>Based on papers of forty two eighth grade children present for all tests.

\*Pearson coefficient of correlation.

This table is to be read as follows: If each child's position in the class distribution for total length of composition be compared with his position in the class distribution for quality of composition, when both positions are expressed in terms of the median deviation of the class as a whole, 33 per cent. of the children will be found to have maintained the same relative position within one unit of variability.

FIGURE 42  
DEGREE OF CORRESPONDENCE BETWEEN ERRORS IN SPELLING AND  
ERRORS IN GRAMMAR



The numbers along the base of the figure represent the 42 individuals of an eighth grade group. The scale along the left hand axis represents units of variability (median deviation above and below the median of the class). The solid line represents variability ratios for errors in spelling. The broken line represents similar ratios for errors in grammar.

The curves show that approximately 50 per cent. of the children maintain the same position in the two distributions within one unit of variability. That is, individual No. 1 makes very few errors in either spelling or grammar. Individual No. 3, however, while at the top of the class in accuracy of spelling, is below the median for number of errors in grammar. Individuals Nos. 12, 25, and 39 represent extreme deviations. Individual No. 37 represents a variant of the opposite type. In other words, he makes many errors in spelling, but is exactly at the median for errors in grammar.

The reader should note that both distributions are badly skewed; the range of variation above the median being a little over 1 and below the median 8.8.



scores. The attempt was made to harmonize the various judgments, but it proved so costly in time, and the final decision seemed to rest upon such uncertain bases, that in view of the lack of comparative data it was decided the results were not worth the time and effort. Accordingly, the averages of the errors recorded by the two examiners were taken as the scores for each individual.<sup>1</sup>

#### FACTORS DETERMINING MERIT

The tabulation of the different types of errors affords a chance to investigate the relation between general merit in composition and its various characteristics—spelling, punctuation, and grammar. It would appear that judgments as to quality of composition are affected more by errors in spelling (coefficient of correspondence 38 per cent.) and still more by errors in capitalization, punctuation, and grammar (52 per cent.) than by the number of different words used (33 per cent.) (Table LXII, page 260). The coefficient of correspondence based upon total mistakes is intermediate between those for spelling and grammar (48 per cent.) (Figure 42, page 261). These coefficients mean that in judging compositions one is influenced now by one factor and now by another.

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<sup>1</sup>A complete record of the scoring for Class No. 45 Froebel will be found in Table LXI, page 256.

## VII. READING

### §1. GENERAL RESULTS

**T**HE Gary schools recognize the importance of reading by allotting to the subject annually 1,323 hours, as compared with 1,280 hours in the conventional school, or 26 per cent. of the time given to fundamentals, as compared with 24 per cent. in conventional schools.

#### READING ABILITY

In current practice the direct teaching of the mechanics of reading rarely extends beyond the third grade. Reading in the higher grades passes over into training in expression, in understanding, and in appreciation. Consequently ability in reading comes to have many meanings, each derived from the situation to which the term is applied. Ability in reading may mean:

- (1) Ability to recognize silently the general meaning of words of a given range of difficulty. (Otis.)
- (2) Ability to "sound" correctly a given set of words. (Jones.)
- (3) Ability to read aloud smoothly and with proper expression (without regard to whether the meaning is understood or not). (Gray.)

- (4) Ability to read either silently or orally and to understand the essential relations existing between the essential elements of what is read. (Curtis.)
- (5) Ability to read either silently or orally and tell in one's own words the substance of what has been read. (Starch, Brown, Gray.)
- (6) Ability to read instructions either silently or orally and be able to act in accordance with the instructions. (Kelly.)
- (7) Ability to read again and again (study) until one has mastered the contents of a passage so that one can answer questions about it or use the information in solving problems. (Thorndike.)
- (8) Ability to read a passage and interpret the allusions which it contains.
- (9) Ability to read a selection and be stirred emotionally by its aesthetic elements.
- (10) Ability to read a passage and interpret the mood, ideas, or ideals of the author.
- (11) Ability to read a selection and make judgments as to its style and merits as a piece of "good English."

And there are doubtless many other possible variations of the senses in which "ability to read" may be understood.

Unfortunately, the makers of tests have not given much attention to this phase of the subject. They have labeled their productions "Tests of Reading," and have been content to say explicitly<sup>1</sup> or to imply that by reading

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<sup>1</sup>Teachers College Record, January 1916, p. 40: An Improved Scale for Measuring Ability in Reading—Thorndike. "Call difficulty for para-

ability is meant the ability to complete this test successfully. But when several such tests are given to the same children, as at Gary, one would seem to have the right to expect that the reading abilities of the children as revealed by one test will show some agreement with the reading abilities revealed by the next test, since both are tests of reading. This, however, is precisely what the results in general do not show.<sup>1</sup>

The tests given at Gary simply reveal the character of the response made by the children to a number of specific situations in which ability in reading enters as one element. To aid the reader in appraising the value of the results and in deciding to what extent each test measures mainly reading or mainly some other abilities, some description of the tests used is necessary.

#### MEASUREMENT OF ORAL READING

In oral reading, the measurable elements are the rate and accuracy of reading, and the quality of expression.

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graph reading a characteristic of a paragraph and question about the paragraph much of which produces a large percentage of wrong responses to the questions, and little of which produces few, the individuals concerned being the same.

"Call achievement in paragraph reading that thing much of which enables an individual to respond correctly to a paragraph and a question about the paragraph involving much difficulty for paragraph reading whereas an individual of less achievement could respond correctly only to a paragraph and a question about the paragraph of less difficulty."

<sup>1</sup>See Richards and Davidson, *School and Society*, Vol. IV, September 2, 1916.

Gray's Oral Reading Scale was used to measure the first two of these elements.

This scale consists of a number of paragraphs each a little more difficult in content, vocabulary, and structure than the one before it. It is essentially a difficulty test; that is, each child begins with simple material well within his range of ability and progresses through the scale until he reaches material which is so difficult that he fails. The time required to read each paragraph and the mistakes made in reading them are noted. It is thus possible to report the results of training in objective terms.

The median ability of eighth grade Gary children in oral reading when thus measured may be inferred from Figure 43, page 267. Half of the eighth grade children are able to read satisfactorily the sample paragraph there shown. (Gray's Standard 4.)<sup>1</sup>

The range of ability in the eighth grade may be comprehended from the samples shown in Figure 44. Approximately 10 per cent. of the children are able to read paragraph B under the standard conditions, while about 10 per cent. are not able to read paragraph C under the standard conditions. That is, the abilities of about 80 per cent. of the eighth grade children fall between these limits.

The abilities of the Gary children expressed in terms of

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<sup>1</sup>A paragraph is accepted under Gray's Standard 4 if read without more than one mistake, or if read in less than 20 seconds without more than two mistakes.

the Gray Scale are as follows: The second grade child of median ability is just not able to read paragraph 1 under Gray's Standard 4, the median third grade child can read paragraph 2, but not paragraph 3, while the median eighth grade child can read paragraph 8, but not paragraph 9.

If successful reading is taken as reading a 'paragraph in less than 40 seconds with not more than six errors (Gray's Standard 1), the median second grade child can read paragraph 3 but not 4, while the median eighth grade child can read paragraph 11 but not paragraph 12.

FIGURE 43  
DIFFICULTY OF MATERIAL REPRESENTED BY EIGHTH GRADE SCORE

SAMPLE A

8

The crown and glory of a useful life is character. It is the noblest possession of man. It forms a rank in itself, an estate in the general good will, dignifying every station and exalting every position in society. It exercises a greater power than wealth, and is a valuable means of securing honor.

Half of the eighth grade children are able to read orally the paragraph above in from 20 to 40 seconds without making more than one mistake, or to read it in less than 20 seconds without making more than two mistakes. (Gray's Standard 4.) The sample is paragraph 8 on Gray's Scale.

FIGURE 44  
VARIATIONS IN EIGHTH GRADE ABILITY

SAMPLE B

10

Responding to the impulse of habit Josephus spoke as of old. The others listened attentively but in grim and contemptuous silence. He spoke at length, continuously, persistently, and ingratiatingly. Finally exhausted through loss of strength he hesitated. As always happens in such exigencies he was lost.

SAMPLE C

3

Once there were a cat and a mouse. They lived in the same house. The cat bit off the mouse's tail. "Pray, puss," said the mouse, "give me my long tail again."

"No," said the cat, "I will not give you your tail till you bring me some milk."

FIGURE 44—*Continued*

Ten per cent. of the eighth grade children are able to read Sample B satisfactorily (under Gray's Standard 4),<sup>1</sup> and 10 per cent. are unable to read satisfactorily Sample C. That is, the ability of 80 per cent. of the eighth grade children ranges between ability to read paragraph B and paragraph C.

Sample B is paragraph No. 10 on Gray's Scale. Sample C is paragraph No. 3 on Gray's Scale. Sample C represents the median development of children in the upper half of the third grade at Gary.

(Table LXIII, page 270.) That is, the development of ability in oral reading at Gary is quite uniform from grade to grade. (Figure 45, page 271).

#### COMPARATIVE DATA<sup>2</sup>

For many who are not directly engaged in teaching, the tables and illustrations given on pages 267 and 268 will have little meaning. Gray's Scale, however, affords a score in points based upon the difficulty of the paragraphs, the time taken to read them, and the number of errors made. In points the Gary second grade score was 27 (Cleveland 42, Grand Rapids 44, St. Louis 47, average of 23 Illinois cities 20) and the Gary eighth grade score 41 (Cleveland 48, Grand Rapids 48, St. Louis 51). (Table LXIV, page 272.) The development of ability in oral reading at Gary closely parallels the development of other cities, but at a level which is about a year below the average of other cities. (Figure 46, page 273.)

<sup>1</sup>To meet Gray's Standard 4, a paragraph must be read without making more than one mistake, or read in less than 20 seconds without making more than two mistakes.

<sup>2</sup>See page 38.



The differences in the performances of the Gary children as compared with those recorded for the average children in conventional schools are brought out by an analysis of the results. Thus, to read paragraph 4 the Gary eighth grade children required 18.7 seconds (Cleveland 16.62, St. Louis 17.85) and made 2.1 mistakes (Cleveland 1.24, St. Louis .73). That is, the Gary children read more slowly and make more mistakes than the children in Cleveland and St. Louis.

Silent reading was tested at Gary by a Reading and Reproduction Test, by the Kansas Silent Reading Test, and by the Trabue Language Scale, but it should be recognized at the outset that, because of the difficulty

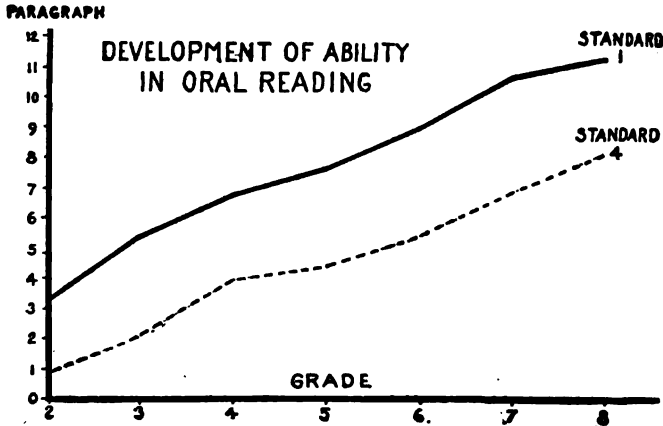
TABLE LXIII  
MEDIAN PARAGRAPHS OF GRAY'S SCALE READ BY THE DIFFERENT GRADES

| GRADE | STANDARD 1 | STANDARD 4 | DIFFERENCE |
|-------|------------|------------|------------|
| 2     | 3.3        | .9         | 2.4        |
| 3     | 5.4        | 2.1        | 3.3        |
| 4     | 6.8        | 3.9        | 2.9        |
| 5     | 7.6        | 4.4        | 3.2        |
| 6     | 9.0        | 5.4        | 3.6        |
| 7     | 10.7       | 6.8        | 3.9        |
| 8     | 11.3       | 8.1        | 3.2        |

STANDARD 1. A paragraph is accepted under Gray's Standard 1 if read in forty or more seconds without more than four mistakes, or if read in less than forty seconds without more than six mistakes.

STANDARD 4. A paragraph is accepted under Gray's Standard 4 if read without more than one mistake, or if read in less than twenty seconds without more than two mistakes.

FIGURE 45  
DEVELOPMENT IN ORAL READING ABILITY—GRAY'S ORAL READING  
SCALE



The scale along the base of the figure represents grades. The scale along the vertical axis represents the paragraphs of Gray's Scale. The solid line shows the median ability of each class under Standard 1 in terms of Gray's Scale. Broken line shows the median ability of each class in terms of Standard 4.

The two curves show there is a steady and quite uniform development throughout the grades.

of the problem and the lack of adequate tests, the measurements of silent reading at Gary are less conclusive than are the measurements previously discussed.

Silent reading is carried on primarily for the reader's benefit. Its most important aspect is the degree of comprehension of meaning, its second, the rate of reading. Unfortunately, however, silent reading, pure and simple, is limited to the perception and comprehension of the

## THE GARY SCHOOLS

TABLE LXIV

## ABILITY IN ORAL READING—GRAY'S ORAL READING SCALE

Scores by points according to Gray's methods. From each class at Gary at least ten children were measured (thirty children or more from classes in grades three, five and seven). Selections were made on basis of teacher's judgment, the three best readers, four average readers, and the three worst readers being chosen.

| GRADE                                     | 2   | 3   | 4   | 5   | 6   | 7   | 8  |
|-------------------------------------------|-----|-----|-----|-----|-----|-----|----|
| Number of children . . . . .              | 102 | 346 | 126 | 297 | 134 | 219 | 52 |
| Gary, Actual Average . . . . .            | 27  | 36  | 39  | 39  | 41  | 42  | 41 |
| 23 Illinois Cities <sup>1</sup> . . . . . | 20  | 27  | 40  | 44  | 45  | 47  | —  |
| Cleveland <sup>2</sup> . . . . .          | 42  | 46  | 47  | 48  | 49  | 47  | 48 |
| Grand Rapids <sup>3</sup> . . . . .       | 44  | 47  | 49  | 50  | 48  | 48  | 48 |
| St. Louis <sup>4</sup> . . . . .          | 47  | 50  | 52  | 51  | 51  | 51  | 51 |

<sup>1</sup>Studies of Elementary School Reading through Standardized Tests—Gray. Page 130.

<sup>2</sup>Studies of Elementary School Reading through Standardized Tests—Gray. Page 121.

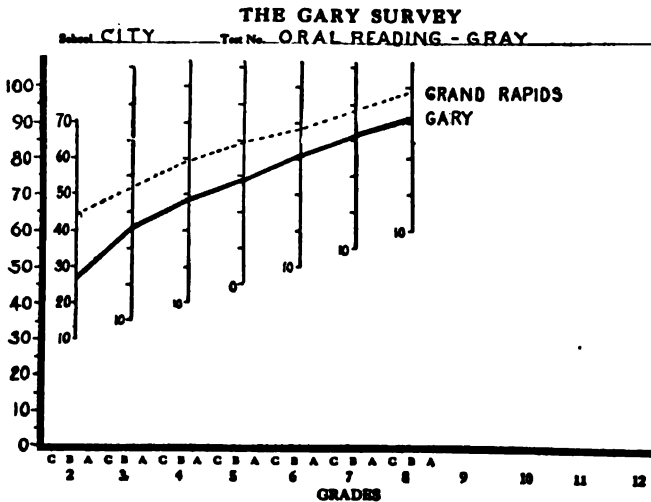
<sup>3</sup>Grand Rapids Survey. Page 66.

<sup>4</sup>Survey of St. Louis Public Schools, Vol. II, p. 126.

This table is to be read as follows: In Gary 102 second grade children, selected as representative children from the various classes tested, made an average score of 27 points when measured with Gray's Scale according to Gray's directions. Twenty three cities in Illinois made an average score of 20 in the second grade, Cleveland—42, Grand Rapids—44, and St. Louis—47.

matter read, while any test of comprehension is necessarily based upon the response an individual makes to the test situation. This brings into play new factors. Accurate measurement of ability in silent reading, therefore, is exceedingly difficult, and at the time of the Gary survey there were no wholly satisfactory tests of silent reading. What is probably the best silent reading test of all, Thorndike's Scale Alpha 2, it was not practical

FIGURE 46  
CITY WIDE AVERAGE SCORES BY GRADES—GRAY'S ORAL READING  
SCALE



The scale along the base of the figure represents grades. The scale along the vertical axis represents scores in terms of Gray's Scale. For methods of computing these scores and of drawing the graph, see § 2. The solid line represents the Gary results; dotted line the scores made by the Grand Rapids pupils. The average difference between the Gary and Grand Rapids results is 7.6 points, while the average annual growth is 5 points. The Gary scores are thus approximately a year and a half lower than those from Grand Rapids.

to use owing to the conditions under which the survey was conducted. However, several of the conventional reading tests were given and while the results do not tell the whole story, they tell enough to show some of the important characteristics of the product.

## REPRODUCTION TESTS

The simplest test of silent reading would seem to be the measurement of the rate at which a story is read, and the quality of a reproduction of the story. This method has been followed by Gray, Starch, Brown, and other investigators. However, a little reflection will show that reproduction is determined more largely by (1) memory and (2) ability in English composition than by ability to read and understand.<sup>1</sup> Hence, reading and reproduction tests were given at Gary to determine (1) the median rate of reading for the different grades, and (2) the stability of the reading habits of the Gary children as measured by individual fluctuations in rate in successive tests.<sup>2</sup>

The test materials were interesting stories taken from children's magazines. A very simple story was used in grades two to five, a little more complex story in grades five to eight, and a portion of an adult biography in grades eight to twelve. Finally a fourth story (child's) was given to grades four to twelve under uniform conditions. Thus all grades from four to twelve were measured at least twice, and some three times. From

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<sup>1</sup>For a critical discussion of what reproduction tests measure and their relation to silent reading, see §2 of this chapter, page 314, and IX of Appendix A, page 443.

<sup>2</sup>The tests were also scored for quality of reproduction according to the conventional plan, but as the writer does not regard the results as significant except as a confirmation of the conclusions of the chapter on English composition, they have been put in IX of Appendix A.

the repeated measurements, tabulations were made, both of the rate of reading and of the amount of individual variation in successive tests.

The median rate at which the eighth grade children read the children's stories were 201 and 207 words per minute respectively. The median rate for the more difficult story was 170 words per minute. A rate of 204 (the average of 201 and 207) words per minute was chosen as best representing the ordinary reading rate of eighth grade children on material suitable for their grade. The corresponding eighth grade rate of oral reading was 200 words per minute (based on paragraphs 2 and 3 of Gray's Oral Reading Scale). That is, the rates of oral and silent reading were nearly the same. (Table LXV, page 276.)

A comparison of the rates of oral and silent reading by grades shows that the rate of oral reading is at first greater than that for silent reading (second grade rate for oral reading 78 words per minute, rate for silent reading 54) but from the sixth grade on it is the rate of silent reading that is the greater (sixth grade oral 183, silent 185). The development of ability in silent reading is rapid in the lower grades (difference between oral and silent reading for grade two was 20 words per minute; grade six, 2 words per minute) but from the sixth grade on the two rates differ but little. (Figure 47, page 278.)

The curve for the development of rate of silent reading is of the conventional type and shows the usual well marked tendency to reach a maximum at the eighth

TABLE LXV

## READING RATE—SILENT AND ORAL

City Wide Median Scores (number of words read per minute) in each of the Silent Reading Tests. Also Generalized City Wide Scores in Silent and Oral Reading.

| GRADE | SILENT READING        |        |        |        | ORAL READING                     |                       |            |
|-------|-----------------------|--------|--------|--------|----------------------------------|-----------------------|------------|
|       | WORDS READ PER MINUTE |        |        |        | COMBINED<br>AND GEN-<br>ERALIZED | WORDS READ PER MINUTE |            |
|       | TEST 1                | TEST 2 | TEST 3 | TEST 4 |                                  | GENERALIZED*          | DIFFERENCE |
| 2     | 54                    | —      | —      | —      | 54                               | 78                    | +24        |
| 3     | 109                   | —      | —      | —      | 109                              | 125                   | +16        |
| 4     | 141                   | —      | —      | —      | 140                              | 160                   | +10        |
| 5     | 160                   | 159    | —      | 139    | 166                              | 172                   | +6         |
| 6     | 183                   | 185    | —      | 186    | 185                              | 183                   | -2         |
| 7     | —                     | 194    | —      | 203    | 198                              | 192                   | -6         |
| 8     | —                     | 201    | 170    | 207    | 204                              | 200                   | -4         |
| 9     | —                     | —      | 202    | 233    | 235                              | —                     | —          |
| 10    | —                     | —      | 218    | 246    | 249                              | —                     | —          |
| 11    | —                     | —      | 216    | 275    | 262                              | —                     | —          |
| 12    | —                     | —      | 219    | 228    | 270                              | —                     | —          |

\*Average difference between actual and generalized scores, 3.3 points. See page 474.

Median deviation in individual rate of reading in two successive tests is 33 words. Based upon 517 individual differences between Tests I and IV for grade four, and between Tests II and IV for grades six and eight.

This table is to be read as follows: The fourth grade at Gary in Test I had a median rate of reading of 141 words per minute, in Test IV of 139 words per minute. The rate of silent reading for the grade is, therefore, taken as 140 words per minute. In the oral reading the generalized median rate for reading paragraphs 2 and 3 of Gray's Scale was 150 words per minute. That is, in the fourth grade the rate of oral reading was 10 words higher than the rate of silent reading.

grade (seventh grade 198 words, eighth grade 204 words). The change of this maximum to a higher level during high school years (ninth grade 235) is readily explained on the basis of the selective action of promotion to high school grades. Therefore, there is at Gary continuous and well marked development of the conventional type of ability to read silently as measured by rate of reading.

In Table LXV, page 276, the median individual variation in rate of reading in two trials of tests composed of material of equal difficulty is given as 33 words per minute. This ranges from 39 words per minute, when the rate of reading is from 10 to 100 words per minute,<sup>1</sup> to 25 words per minute, when the rate of reading varies from 300 to 380 words per minute.<sup>2</sup> In other words, the variability of a child's performance decreases as the rate of reading increases. Children who read but 60 or 70 words per minute in one test will, in half the cases, make a score of 105 or more words per minute in a second trial with material of equal difficulty, or vice versa, but children who read at the rate of 350 words per minute, in a second test will, in half the cases, not make scores of more than 375 words per minute in a second trial. That is, for slow, immature readers the variation at Gary is 67 per cent. while for rapid readers it is but 7 per cent. of their rate. The median rate of variation for 118 eighth grade children was 20 per cent. This

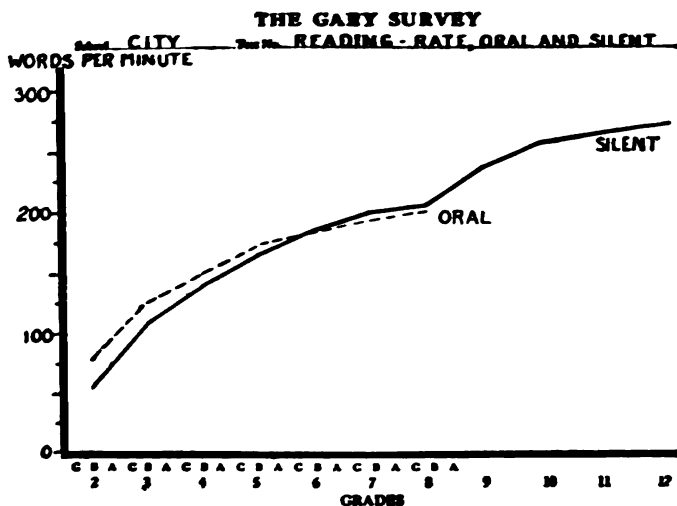
<sup>1</sup>Median of 103 cases, 58 words per minute.

<sup>2</sup>Median of 20 cases, 365 words per minute.



## THE GARY SCHOOLS

FIGURE 47  
COMPARATIVE RATES OF ORAL AND SILENT READING



The scale along the base of the figure represents grades. The scale along the vertical axis represents number of words read per minute. Oral reading is based upon the rate of reading paragraphs one and two of Gray's Scale; story of approximately equal difficulty. The solid line—silent reading; the dotted line—oral reading.

The curve for the development of rate of silent reading is of the conventional type and shows a tendency to approach a maximum at the eighth grade. The portion of the curve for high school years reaches a higher level. This is probably due to the selective effect of promotion to high school upon ability. The rate of oral reading in the lower grades is slightly higher than the rate for silent reading, but in the upper grades this condition is reversed. This probably means that the emphasis of instruction in the Gary schools on oral reading operates to prevent proper development of ability in silent reading.

indicates that there are many eighth grade children whose reading abilities are unstable. Unfortunately, no comparative data are available on this point so that it is impossible to tell whether conditions at Gary are better or worse than elsewhere. This degree of variability probably represents an undesirable characteristic of the product of instruction in reading.

#### COMPARATIVE DATA<sup>1</sup>

At Gary the eighth grade rate of reading orally paragraph 1 on Gray's Scale was 204 words per minute, while in Cleveland it was 214 words, and in St. Louis 179 words. For paragraph 4, a more difficult paragraph, the rate at Gary was 196 words, at Cleveland 220, and at St. Louis 205. (Table LXVI, page 280.)

Similarly, the eighth grade rate for silent reading was, at Gary, 204 words per minute, while the rate recorded by Starch is 240 words, by Gray 234 words, by Brown 290 words, by Courtis 280 words, and by the Salt Lake City survey 209 words. (Table LXVII, page 282.)

#### KANSAS SILENT READING TESTS

The Kansas Silent Reading Tests consist of a number of short paragraphs each of which directs the child to make some response, and the accuracy with which this is done indicates whether or not he has read the directions understandingly. As illustrations of their character the

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<sup>1</sup>See page 38.

## THE GARY SCHOOLS

TABLE LXVII

COMPARATIVE DATA FOR RATES OF SILENT READING

| GRADE | GARY <sup>1</sup> | STARCH <sup>2</sup> | SALT<br>LAKE<br>CITY <sup>3</sup> | GRAY <sup>4</sup> |          | BROWN <sup>5</sup> | COURTIS <sup>6</sup> |                    |
|-------|-------------------|---------------------|-----------------------------------|-------------------|----------|--------------------|----------------------|--------------------|
|       |                   |                     |                                   | ACTUAL            | ADJUSTED |                    | NORMAL<br>READING    | CAREFUL<br>READING |
| 2     | 54                | 108                 | —                                 | 90                | 90       | —                  | —                    | —                  |
| 3     | 109               | 126                 | —                                 | 138               | 138      | 199                | —                    | —                  |
| 4     | 140               | 144                 | —                                 | 132               | 180      | 213                | 161                  | 106                |
| 5     | 166               | 168                 | 189                               | 152               | 204      | 269                | 180                  | 183                |
| 6     | 185               | 192                 | 212                               | 167               | 216      | 272                | 226                  | 172                |
| 7     | 198               | 216                 | 219                               | 161               | 228      | 279                | 256                  | 178                |
| 8     | 204               | 240                 | 209                               | 172               | 234      | 290                | 262                  | 200                |
| 9     | 235               | —                   | —                                 | —                 | —        | —                  | —                    | —                  |
| 10    | 249               | —                   | —                                 | —                 | —        | —                  | —                    | —                  |
| 11    | 262               | —                   | —                                 | —                 | —        | —                  | —                    | —                  |
| 12    | 270               | —                   | —                                 | —                 | —        | —                  | —                    | —                  |

<sup>1</sup>On the basis of uniform material.<sup>2</sup>Educational Measurements, p. 39. Material increases in difficulty from lower to higher grades.<sup>3</sup>Report of Salt Lake City Survey, p. 160. Uniform material.<sup>4</sup>Scale from diagram 17, Studies of Elementary School Reading through Standardized Tests—Gray. Adjusted rates are on basis of uniform material.<sup>5</sup>Bulletin No. 1, Bureau of Research, Department of Public Instruction, New Hampshire, p. 57. Variable material.<sup>6</sup>Fourteenth Yearbook of the National Society for the Study of Education, p. 50. Uniform material.

Rates in different cities are based on different materials, hence the results are of value only for general comparisons.

This table is to be read as follows: In Gary, the fifth grade children read silently a simple story at the rate of 166 words per minute. According to Starch the average rate at which fifth grade children should read stories silently is 168 words per minute. In Salt Lake City the average rate for the fifth grade was 189 words per minute. According to Gray the rate is 152 words per minute on difficult material or 204 words per minute if adjustment is made for difficulty. (Based on scores of 13 cities of Iowa, Minnesota, Tennessee, and Illinois.) His method of computing rate of silent reading is considered later. According to Brown, the best average made by any fifth grade class so far measured by him is 269 words per minute. According to Courtis, the average rate of normal reading is 180 words per minute; of careful reading 133 words per minute.

FIGURE 48  
SAMPLE PARAGRAPHS FROM THE KANSAS SILENT READING TESTS

PARAGRAPH A FROM TEST I

*Value* I have red, green and yellow papers in my  
1.2 hand. If I place the red and green papers on  
the chair, which color do I still have in my hand?

---

PARAGRAPH B FROM TEST I

*Value* Think of the thickness of the peelings of  
1.2 apples and oranges. Put a line around the  
name of the fruit having the thinner peeling.

Apples Oranges.

PARAGRAPH C FROM TEST II

*Value* In going to school, James has to pass John's  
2.3 house, but does not pass Frank's. If Harry  
goes to school with James whose house will  
Harry pass, John's or Frank's?

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PARAGRAPH D FROM TEST II

*Value* Here are two squares. Draw a line from the  
2.6 upper left-hand corner of the small square to  
the lower right-hand corner of the large square.



FIGURE 48—*Continued*

## PARAGRAPH E FROM TEST III

*Value*      Bone is composed of animal matter and mineral matter. The former gives it toughness and the latter rigidity. Yesterday I placed a bone from a chicken's leg in a bottle of acid, and found this morning that I could wrap the bone around my finger like gristle. Which kind of matter was removed from the bone?

4.3

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## PARAGRAPH F FROM TEST III

*Value*      There are three horizontal lines; the first is three inches in length, the second two inches, the third one inch. We know that if the second and third lines are joined end to end the resulting line will be as long as the first line. Suppose that the first and second lines are joined end to end. How many times as long as the third line will the resulting line be?

4.8

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Paragraphs A and B from Test I (for grades three, four, and five).  
Paragraphs C and D from Test II (for grades five, six, seven, and eight).  
Paragraphs E and F from Test III (for high school grades).

These paragraphs were selected as representative of the different types of activities called for in the test. It should be noted that while the

FIGURE 48—*Continued*

reading activity is one element determining a correct response, it is but one. The Kansas Tests probably measure the ability to read and understand, and to think or reason about what is read.

to nine and Test III from grades eight to twelve. The conventional scores were found according to the standard instructions, and for comparative purposes only those results were taken which were derived from tests given to the grades and under the conditions provided in the standard directions. For the discussion of the conditions as they appear at Gary, however, the results from Test I (for all three tests in the eighth grade) were tabulated for rate of work (total number of points attempted) and for accuracy (ratio of points right to points attempted, expressed as rate per cent).<sup>1</sup>

The eighth grade at Gary attempted 23.9 points in Test I with an accuracy of 83 per cent. (Table LXVIII, page 287). Both the rate and the accuracy of work increase quite regularly throughout the grades (third grade 12.3 points attempted, 28 per cent. accuracy) showing that the development of ability in rate is of the conventional type (Figure 49, page 288). The ninth grade scores indicate a very great increase over those of the eighth grade (23.9 to 34.0 points attempted and 83 to 88 per cent. accuracy), but this may be due to difference in conditions under which the tests were given.

The reader should note that the level of accuracy

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<sup>1</sup>The reader should note that this method of tabulation is a departure from conventional methods. See also page 186.

reached by the eighth grade is 83 per cent. That is, half the children in the eighth grade are able to read the simple paragraphs designed for the measurement of the ability of the third grade children only well enough to give correct answers to a little more than eight out of ten questions. This will furnish the reader with a basis of estimating directly the degree of ability in reading of the Gary eighth grade children, and of interpreting the results given in the table.<sup>1</sup>

In terms of the conventional score for the Kansas Test, the ability of the eighth grade is about 21 points (Test I, 21.3 points; Test II, 18.7 points, Test III, 22.1 points). (Figure 50, page 289.)

#### COMPARATIVE DATA<sup>2</sup>

The scores of the Gary eighth grade classes are practically the same as the corresponding scores made by classes in other cities (Gary 18.7, Kansas 20.1, Iowa 20.6, Detroit 19.0, New Orleans 19.1, combined tabulations from all parts of the country 19.2). The scores of the third grade at Gary are very much below those made by other cities (Gary 2.5, median of country 5.3) (Table LXIX, page 290). That is, the abilities measured by the Kansas Reading Tests begin to develop later at Gary

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<sup>1</sup>The reader should note that this statement stands by itself and has no significance from the comparative point of view. In the absence of comparative data, it is impossible to say whether this performance is better or worse than that of children in conventional schools.

<sup>2</sup>See page 38.

TABLE LXVIII  
CITY WIDE MEDIAN SCORES—KANSAS READING TESTS

| GRADE | GARY TEST I |           | GARY TEST I† | GARY TEST II | GARY TEST III |
|-------|-------------|-----------|--------------|--------------|---------------|
|       | RATE        | ACCURACY† |              |              |               |
| 3     | 12.8        | 28.2      | 2.5          | —            | —             |
| 4     | 14.9        | 50.1      | 6.7          | 5.6          | —             |
| 5     | 18.1        | 59.8      | 9.8          | 9.9          | —             |
| 6     | 20.5        | 68.5      | 18.8         | 11.9         | —             |
| 7     | 23.8        | 75.2      | 18.8         | 15.8         | —             |
| 8     | 23.9        | 83.       | 21.8         | 18.7         | 22.1          |
| 9     | 20.4 34.0*  | 87.8      | 14.2 23.7*   | 22.2         | 24.5          |
| 10    | 20.1 33.5*  | 92.7      | 16.7 27.8*   | —            | 29.2          |
| 11    | 20.2 33.7*  | 97.7      | 17.7 29.5*   | —            | 33.5          |
| 12    | 18.5 30.8*  | 95.7      | 16.8 28.0*   | —            | 29.6          |

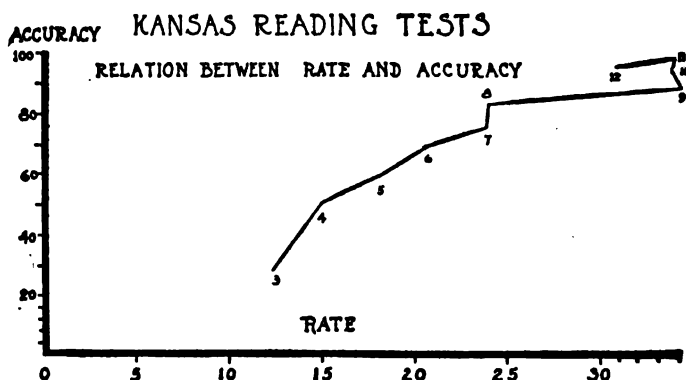
\*Smaller values, actual scores made in three minutes; larger values, scores computed on basis of five minutes, the standard time allowance.

† Disagreement due to difference in method of tabulation.

This table is to be read as follows: The third grade children in the Kansas Silent Reading Tests attempted 12.3 points in the time allowed, of which 28.2 per cent. were correct. The score of this grade computed in the manner provided by Kelly is 2.5 points. The score of the ninth grade in Test I was 20.4 points attempted in three minutes, from which the amount that would have been done in five minutes, the time allowed the lower grades, was computed to be 34.0 points. The accuracy of the ninth grade was 87.8 per cent. The score of the ninth grade as determined in the manner provided in the instructions, 14.2 points right in three minutes, or 23.7 points right in five minutes. In Test II it was 22.2 points right in five minutes, and in Test III it was 24.5 points right in five minutes. The three scores 23.7, 22.2, and 24.5 show how correctly the three tests have been weighted to give scores of equal value.



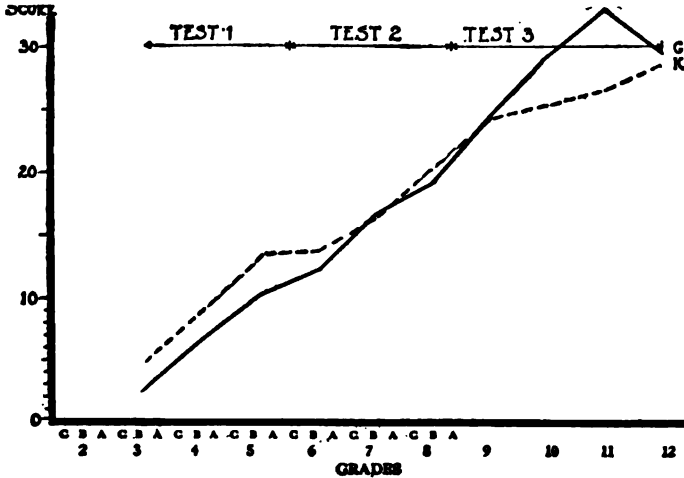
FIGURE 49  
DEVELOPMENT IN RATE AND ACCURACY—KANSAS SILENT READING  
TESTS



The scale along the base of the figure shows the number of points tried. The scale along the vertical axis shows the per cent. the points right are of the points tried. The position of the various grade median scores is shown by the figures on the curve.

Ability to read the simple material in the test devised for the third grade develops quite regularly through the seventh grade. The eighth grade has a score which is greater in accuracy only. The high school grades are very much higher in rate and somewhat higher in accuracy. The break between the eighth and ninth grades is probably due in part to the selective action of promotion to high school upon ability and in part to the fact that in these grades it was necessary to stop the tests at the end of three minutes and compute the score that would have been made in five minutes. The curve for the development of reading ability in Gary is of quite the conventional type.

FIGURE 50  
DEVELOPMENT IN ACCURACY—KANSAS SILENT READING TESTS  
(CONVENTIONAL SCORES)



The scale along the base of the figure represents grades. The vertical scale represents the score in Kansas Silent Reading Tests as determined from the right answers according to the standard instructions. The solid line represents Gary; the dotted line, scores made by about 9,000 children in 19 cities in Kansas.

The Gary results are lower than the Kansas results in grades three, four, and five, and equal to the Kansas results in grades six, seven, eight, and nine, and are very much above the Kansas results in other high school years.

than in the conventional schools, but by the seventh and eighth grades the handicap of the late start has been overcome. The scores in high school years at Gary are equal

TABLE LXIX  
COMPARATIVE DATA<sup>1</sup>—KANSAS SILENT READING TEST\*

| GRADE                                                 | 3   | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
|-------------------------------------------------------|-----|------|------|------|------|------|------|------|------|------|
| Gary.....                                             | 2.5 | 6.7  | 9.8  | 11.9 | 15.3 | 18.7 | 24.5 | 29.2 | 33.5 | 29.6 |
| Kansas—1st Class cities.....                          | 4.8 | 8.8  | 13.1 | 13.8 | 16.1 | 19.7 | 25.8 | 27.1 | 27.8 | 29.7 |
| “ 2nd “.....                                          | 5.9 | 9.7  | 14.3 | 14.3 | 17.3 | 20.6 | 33.7 | 33.6 | —    | —    |
| “ 3rd “.....                                          | 4.6 | 8.2  | 11.8 | 12.5 | 14.0 | 20.6 | 20.6 | 23.7 | 26.0 | 27.6 |
| “ Total.....                                          | 4.9 | 9.0  | 13.4 | 13.7 | 16.1 | 20.1 | 24.8 | 26.2 | 26.5 | 28.4 |
| Iowa.....                                             | 6.2 | 9.5  | 14.6 | 14.8 | 17.7 | 20.6 | —    | —    | —    | —    |
| S. A. States.....                                     | 6.0 | 9.2  | 13.9 | 11.6 | 14.5 | 15.8 | 21.8 | 20.7 | 25.0 | 39.8 |
| N. A. States.....                                     | 5.3 | 9.6  | 12.9 | 13.6 | 16.7 | 17.8 | 24.8 | 28.9 | 22.8 | 27.0 |
| S. C. States.....                                     | 4.7 | 8.4  | 12.3 | 11.8 | 15.4 | 19.2 | 22.4 | 24.5 | 25.0 | 29.2 |
| N. C. States.....                                     | 5.1 | 9.3  | 13.1 | 13.6 | 16.2 | 18.2 | 21.5 | 25.7 | 26.5 | 31.8 |
| Western States.....                                   | 6.1 | 10.6 | 14.4 | 15.0 | 18.0 | 20.6 | 23.5 | 26.0 | 26.4 | 31.4 |
| Combined Scores from all parts<br>of the country..... | 5.3 | 9.5  | 13.0 | 13.9 | 16.2 | 19.2 | 22.9 | 25.6 | 26.5 | 29.7 |
| Detroit.....                                          | 6.3 | 10.6 | 13.7 | 13.8 | 17.0 | 19.0 | —    | —    | —    | —    |
| New Orleans.....                                      | 4.8 | 8.0  | 12.0 | 11.3 | 15.0 | 19.1 | —    | —    | —    | —    |

<sup>1</sup>See page 36.

\*Scores based upon the use of Test I in grades three to five, Test II in grades six to eight, Test III in grades nine to twelve. Comparative data taken from Bulletin No. 6, Kansas State Normal School, Emporia, Kansas.

The number of pupils in the higher grades is not sufficient to give reliable standards in a few cases. This is particularly true of the second class cities in Kansas, the State of Iowa, and the South Atlantic States.

to or much greater than the corresponding scores in other cities, although the data for this statement are less complete than for the comparisons in the other grades (twelfth grade 29.6, median of country 29.7). As measured by the Kansas Reading Tests, the eighth grade product of the instruction in reading in the grades at Gary is equal to that of the conventional school.

#### TRABUE LANGUAGE SCALES

The Trabue Language Scales consist of ten sentences differing in complexity, in which one or more words are missing. Children are asked to supply the missing words. Three representative sentences are shown in Figure 51, page 292. From these it may be seen that the Trabue Test measures a complex of many abilities, of which reading is but one.

The scales are issued in the form of four tests, known respectively as B, C, D, and E. A child is given as much time as he needs and his score does not show the amount of work done in this time, but the difficulty of the most difficult sentence that he is able to complete. Thus except for certain minor irregularities in scoring imperfect answers, a child who is able to complete correctly sentence 2 in Figure 51 would be given a score of 10, while a child who was able to complete correctly sentence 3 in Figure 51 would be given a score of 20. Sentence 3 is twice as hard as sentence 2 in terms of the units adopted for measurement of the difficulty of these sentences. The score of a class, therefore, is to be interpreted in terms

not of amount of work, but of the degree of difficulty of sentence which the class is able to solve correctly without regard to the time required. It is perfectly possible, however, to use the Trabue Tests as rate tests and determine the rate and accuracy of work in order to secure a different type of information about the development of the abilities represented by these tests. At Gary Scales B and C were given under standard conditions, and Scales D and E were given under a time limit (two minutes).

FIGURE 51  
ILLUSTRATIVE SENTENCES, TRABUE LANGUAGE SCALE C

| SENTENCES                                                                                                                | TYPICAL CORRECT<br>ANSWERS                          |
|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| 1. The sky ——— blue.                                                                                                     | (is)                                                |
| 2. The ——— rises ——— the morning and ——— at night.                                                                       | (sun, in, sets)                                     |
| 3. One ought to ——— great care to ——— the right ——— of ———, for one who ——— bad habits ——— it ——— to get away from them. | (take, form, kind, habits, forms, finds, difficult) |

The median eighth grade child at Gary has an ability represented by a score of 14.0 in Scales B and C, or of 12.9 and 12.3 respectively in Scales D and E when given under limited time conditions. Considering the entire range of scores from 6.5 for the third grade to

16.0 at the twelfth grade, the value which best represents eighth grade ability is probably 13.6 (Table LXX, page 294). The development in the lower grades is rapid (from 6.5 at the third grade to 8.5, or 2.0 points increase at the fourth grade) and gradually decreases as the upper grades are reached (eighth to ninth grade difference, .7; eleventh to twelfth grade difference, .5). The development is, therefore, of the conventional type (Figure 52, page 295).

#### COMPARATIVE DATA<sup>1</sup>

A comparison of the Gary scores with the standards published by Trabue shows almost perfect correspondence at all grades (third grade difference, Gary, +.5; eighth grade difference, +.3; twelfth grade difference, —.2). The differences are sometimes positive and sometimes negative and are insignificant in amounts. Comparisons with such other scores as are available show the Gary scores slightly lower (eighth grade comparisons, Gary—Detroit, —2.4; Gary—Chatham, —2.1; Gary—Nassau County, —.4). Table LXXI, page 296.) On this basis the Gary schools would be judged slightly<sup>2</sup> below conventional schools in the products measured by these scales.

#### SCHOOL TO SCHOOL COMPARISONS

Rather marked differences in reading ability from school to school are evident. Thus, in oral reading the Emerson School is distinctly better than the other three schools. In silent reading the Froebel and Beveridge

<sup>1</sup>See page 38.

<sup>2</sup>See footnote, page 296.

## THE GARY SCHOOLS

TABLE LXX

## SCORES IN TRABUE LANGUAGE SCALES

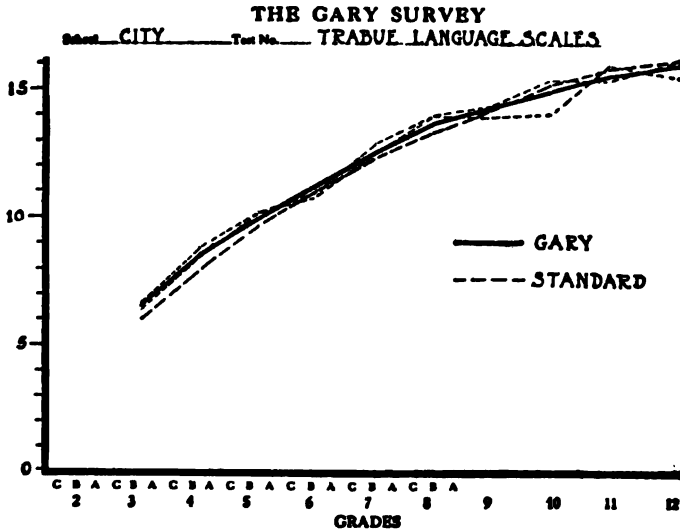
Scales B and C given under standard conditions. Scales D and E given on a two minute time allowance instead of a seven minute allowance.

| GRADE | SCALE<br>B | SCALE<br>C | SCALE<br>D | SCALE<br>E | GENERALIZED<br>GARY SCORE |
|-------|------------|------------|------------|------------|---------------------------|
| 3     | 6.3        | 6.7        | 5.5        | 5.1        | 6.5                       |
| 4     | 8.5        | 8.8        | 8.2        | 8.3        | 8.5                       |
| 5     | 10.2       | 10.2       | 9.7        | 9.9        | 9.9                       |
| 6     | 10.7       | 10.9       | 10.7       | 10.7       | 11.2                      |
| 7     | 12.9       | 12.5       | 12.6       | 11.7       | 12.5                      |
| 8     | 14.0       | 14.0       | 12.9       | 12.3       | 13.6                      |
| 9     | 14.4       | 13.9       | 13.8       | 12.7       | 14.3                      |
| 10    | 15.4       | 14.0       | 13.5       | 14.4       | 14.9                      |
| 11    | 15.3       | 16.0       | 14.7       | 14.4       | 15.5                      |
| 12    | 16.2       | 15.5       | 14.4       | 14.5       | 16.0                      |

The table is to be read as follows: The median third grade score in Scale B was 6.3; in Scale C, 6.7; in Scales D and E, given under limited time conditions, 5.5 and 5.1 respectively. Considering the entire range of grade scores in Scales B and C, 6.5 has been set as best representing third grade development.

schools read more rapidly than the other two, but in the reproduction test the Beveridge School falls much below those of the other three. As measured by the Kansas Silent Reading Test, the Jefferson School makes the best showing, with the Emerson a close second. Both the Froebel and the Beveridge schools have many low scores. In the scores from the Trabue Language Scales the differences are less marked. Froebel is again distinctly below the level of the Emerson and Jefferson, but the Beveridge does not differ markedly from them. It is probable,

FIGURE 52  
DEVELOPMENT OF ABILITIES—TRABUE LANGUAGE SCALES



The scale along the base of the figure represents grades. The scale along the vertical axis indicates the median degree of development attained in Trabue units. The solid line, Gary. The broken line, Trabue Standard. The dotted line, actual score of Tests B and C.

The Gary children do quite as well as, or a little better than, children in other schools, according to Trabue's Standard.

therefore, that the differences summarized in Table LXXII, page 298, represent merely the effect of foreign parentage rather than any significant difference due to the extent to which the schools afford modern programs.

<sup>1</sup>See footnote on page 296.



TABLE LXXI  
COMPARATIVE SCORES—TRABUE LANGUAGE SCALES

| GRADE | GENERALIZED<br>GARY SCORES | TRABUE<br>STANDARDS <sup>1</sup> | DETROIT,<br>MICH. | CEATHAM,<br>N. J. | MOBILE,<br>ALA. | NASSAU COUNTY,<br>L. I. |
|-------|----------------------------|----------------------------------|-------------------|-------------------|-----------------|-------------------------|
| 3     | 6.5                        | 6.0                              | 9.3               | —                 | —               | —                       |
| 4     | 8.5                        | 8.0                              | 11.5              | 10.7              | 11.7            | 10.2                    |
| 5     | 9.9                        | 9.6                              | 12.8              | 11.7              | 12.7            | —                       |
| 6     | 11.2                       | 11.0                             | 13.2              | 12.2              | 13.9            | 12.2                    |
| 7     | 12.5                       | 12.3                             | 14.2              | 14.8              | 14.4            | —                       |
| 8     | 13.6                       | 13.3                             | 16.0              | 15.7              | —               | 14.0                    |
| 9     | 14.3                       | 14.2                             | —                 | 17.2              | —               | —                       |
| 10    | 14.9                       | 15.3                             | —                 | —                 | —               | —                       |
| 11    | 15.5                       | 15.8                             | —                 | —                 | —               | —                       |
| 12    | 16.0                       | 16.2                             | —                 | —                 | —               | —                       |

<sup>1</sup>Since this report was written Trabue has changed his standards. The old standards were based on a 56 sentence test. The new standards are based upon the direct use of the tests used at Gary. The new standards are: Third grade, 8.0; fourth, 10.0; fifth, 11.4; sixth, 12.4; seventh, 13.4; eighth, 14.4; ninth, 15.2; tenth, 16.0; eleventh, 16.7; twelfth, 17.4.

The table is to be read as follows: The Gary generalized third grade score was 6.5 points. The Trabue Standard score for this grade is 6.0; Detroit third grade score, 9.3 points, etc.

## TRABUE LANGUAGE SCALE B

MEDIAN SCORES GRADES<sup>1</sup>

| CITIES                                      | 5th                        | 6th                        | 7th                        | 8th                        |
|---------------------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| TRABUE STANDARD...                          | 11.4<br>5A-11.1<br>5B-11.6 | 12.4<br>6A-12.2<br>6B-12.6 | 13.4<br>7A-13.1<br>7B-13.6 | 14.4<br>8A-14.1<br>8B-14.6 |
| OMAHA (January)....                         | 11.0<br>5A-10.9<br>5B-11.0 | 12.4<br>6A-12.4<br>6B-12.5 | 13.4<br>7A-13.3<br>7B-13.6 | 14.7<br>8A-14.7<br>8B-14.8 |
| Louisville (White)....                      | 12.4                       | 13.5                       | 14.4                       | 15.3                       |
| St. Paul.....                               | 11.1                       | 12.2                       | 13.1                       | 14.0                       |
| Rochester, N. Y.....                        | 11.55                      | 12.57                      | 14.37                      | 14.75                      |
| Horace Mann School<br>(Columbia University) |                            |                            | 16.2                       | 17.1                       |
| Pacific School-Seattle.                     | 10.9                       | 12.1                       | 13.3                       | 13.7                       |
| Nassau Co., N. Y.....                       |                            | 12.4                       |                            | 14.0                       |
| Janesville, Wis.....                        | 11.3                       | 12.8                       | 13.6                       | 14.3                       |
| Mobile, Ala.....                            | 11.7                       | 12.7                       | 13.9                       | 14.4                       |
| Chatham, N. J.....                          | 11.7                       | 12.2                       | 14.8                       | 15.8                       |
| Deadwood, S. Dak....                        | 11.0                       | 12.8                       | 13.0                       | 13.3                       |
| Muscatine, Ia. (January).....               | 10.9                       | 12.2                       | 13.1                       | 14.3                       |
| Cherokee, Ia.....                           | 10.9                       | 12.7                       | 14.0                       | 14.4                       |
| Washington, Ia. (June)                      | 12.3                       | 13.4                       | 14.0                       | 14.4                       |
| Webster City, I..<br>(March).....           | 11.8                       | 12.6                       | 13.2                       | 14.9                       |
| Storm Lake, Ia. (Nov.)                      | 11.4                       | 12.9                       | 13.2                       | 13.9                       |
| Sutherland, Ia.....                         | 11.3                       | 13.4                       | 13.5                       | 14.4                       |
| Gary.....                                   | 10.2                       | 10.7                       | 12.9                       | 14.0                       |

<sup>1</sup>From Bulletin of Department of Educational Research, Omaha, Neb.

## §2. CRITICAL DISCUSSION

## GRAY'S ORAL READING SCALE

A consideration of each of the various reading tests is now in order, the first of which is Gray's Oral Reading Scale. No discussion of the methods by which the scale

TABLE LXXII

## SCHOOL TO SCHOOL COMPARISONS

Number of Classes Whose Scores Vary from the City Wide Grade  
Median More Than One Tenth the Generalized Score

| ORAL READING |                            |   |   | SILENT READING—STORY       |   |   |                            |   |   |
|--------------|----------------------------|---|---|----------------------------|---|---|----------------------------|---|---|
| GRAY'S SCALE |                            |   |   | RATE OF<br>SILENT READING  |   |   | RATE OF<br>REPRODUCTION    |   |   |
| SCHOOL       | TOTAL<br>NO. OF<br>CLASSES | + | - | TOTAL<br>NO. OF<br>CLASSES | + | - | TOTAL<br>NO. OF<br>CLASSES | + | - |
| Froebel      | 28                         | 7 | 7 | 32                         | 9 | 3 | 32                         | 7 | 5 |
| Emerson      | 12                         | 5 | 1 | 18                         | 4 | 6 | 18                         | 2 | 3 |
| Jefferson    | 16                         | 2 | 3 | 18                         | 4 | 7 | 18                         | 2 | 1 |
| Beveridge    | 11                         | 2 | 2 | 17                         | 5 | 5 | 17                         | 2 | 8 |

| KANSAS SILENT READING TEST |                            |    |    | TRABUE LANGUAGE SCALE   |   |   |
|----------------------------|----------------------------|----|----|-------------------------|---|---|
| SCHOOL                     | TOTAL<br>NO. OF<br>CLASSES | +  | -  | TOTAL NO. OF<br>CLASSES | + | - |
| Froebel                    | 30                         | 6  | 15 | 22                      | 0 | 6 |
| Emerson                    | 15                         | 6  | 1  | 11                      | 3 | 0 |
| Jefferson                  | 16                         | 10 | 1  | 16                      | 4 | 2 |
| Beveridge                  | 15                         | 3  | 9  | 13                      | 3 | 2 |

This table is to be read as follows: In the Froebel school, of 28 classes tested in oral reading, 7 classes had scores markedly above the city wide medians and 7 classes had scores markedly below. In rate of silent reading, of 32 classes tested, 9 had scores markedly above the city wide medians and 3 below. In rate of reproduction, of 32 classes tested, 7 had scores markedly above the city wide medians and 5 below. In the Kansas Silent Reading Tests, of 30 classes tested, 6 had scores markedly above the city wide medians and 15 below. In the Trabue Language Scale, of 22 classes tested, none had scores markedly above the city wide medians and 6 below.

was derived or of the principles upon which it is based is necessary, as the same are available elsewhere.<sup>1</sup>

There are, however, certain criticisms of the scale itself and certain points connected with its use at Gary which the reader should know.

Gray's Oral Reading Scale as given at Gary measures the ability to "sound" connectedly and correctly the words in a given passage. It does not measure expression nor does it measure understanding. The attempt was made to have the examiner record his judgment as to the quality of the expression in the reading, but it was found impossible to compare expression with a standard, except on the most intangible and subjective basis. The examiners soon decided their records were so unreliable as to be worthless, and the practice was discontinued.

It is possible to ask a child to reproduce orally or in writing what has been read, or to answer questions in regard to the same. However, this was not attempted systematically at Gary. The scale thus affords merely a measure of the child's performance in oral reading. If he mispronounces words, omits words, or adds to the text, if he repeats, or otherwise misreads, the errors take away from his score. The giving of the test is well standardized and there are adequate and reliable comparative data. As a whole, therefore, the test is a satisfactory measure of skill in oral reading, so far as that skill

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<sup>1</sup>Gray, W. S., *Studies of Elementary School Reading through Standardized Tests*. Supplementary Educational Monograph No. 1, University of Chicago Press.

is defined as ability to pronounce words correctly and in proper sequence.

One limitation of the scale is that the causes of the increasing difficulty from paragraph to paragraph are not known and may be due to factors not vitally connected with reading ability. A single illustration will make this plain. Paragraphs 2, 3, and 4 have for the first word "once"; "Once there was," "Once there were," "Once there lived." Paragraph 5, however, begins "One of the most interesting birds." Child after child influenced by the preceding paragraphs begins: "Once of the." Thus in class No. 11 Jefferson, out of 40 children, 5 missed on this particular point. Tabulation of other classes yielded similar results. In general, one child in 10 is so susceptible to the habit forming influence of the succession of "onces" that he will mis-read "one" in paragraph 5. In other words, in working with the scale one gains the impression that the difficulty of certain paragraphs of the scale is in part caused by the occurrence of certain traps or pitfalls, rather than by real increases in the difficulty of the reading. This is due, of course, to the empirical basis on which the selection of the paragraphs rests.

On the other hand, an inspection of the scale shows that there is in general a real increase in difficulty of vocabulary, in length of sentence, in difficulty of sentence structure, and in content of material.

The length of the sentences in the various paragraphs increases from 7 words to 23, but the increase is

irregular (Table LXXIII, page 302). A word, however, is a poor unit to use in measuring length of sentence as words vary so in size. A better unit would seem to be "sound divisions" or syllables. A syllable in the conventional sense means merely a group of letters. Syllables are not always sounded. Thus "dressed," a two syllable word on the basis of spelling, is pronounced as though it were spelled "drest"; that is, as a single sound unit. The term "sound division" or "sound unit" will be used to indicate that words have been divided in accordance with their pronunciation, and not in accordance with their spelling.

From the point of view of such sound division, the sentence length varies from an average of 8 to over 45 units, but again the increase is irregular. To say that a child can read one paragraph but cannot read the next higher one is to indicate but roughly the length of sentence which he can read. In future improvements of the scale attention will need to be given to a more careful gradation of sentence length from paragraph to paragraph.

In similar fashion it was found that a word of six sound divisions occurs in paragraphs 10 and 11, while paragraph 2 has but five words of more than a single sound. Roughly, therefore, the paragraphs increase in difficulty because of the increase in the length of the words as well as the length of the sentence, but for this factor also the increase is irregular (Table LXXIV, page 303).

## THE GARY SCHOOLS

TABLE LXXIII

ANALYSIS OF GRAY'S ORAL READING SCALE

| PARAGRAPH<br>NUMBER | NUMBER<br>OF<br>SENTENCES<br>IN<br>PARAGRAPH | NUMBER<br>OF<br>WORDS | NUMBER<br>OF SOUND<br>DIVISIONS | AVERAGE<br>WORDS<br>PER<br>SENTENCE | AVERAGE<br>SOUNDS<br>PER<br>SENTENCE |
|---------------------|----------------------------------------------|-----------------------|---------------------------------|-------------------------------------|--------------------------------------|
| 1                   | 7                                            | 48                    | 55                              | 6.9                                 | 7.9                                  |
| 2                   | 6                                            | 49                    | 54                              | 8.1                                 | 9.0                                  |
| 3                   | 5                                            | 49                    | 51                              | 9.8                                 | 10.2                                 |
| 4                   | 6                                            | 61                    | 72                              | 10.1                                | 12.0                                 |
| 5                   | 3                                            | 60                    | 75                              | 20.0                                | 25.0                                 |
| 6                   | 4                                            | 62                    | 81                              | 15.5                                | 20.2                                 |
| 7                   | 3                                            | 53                    | 74                              | 17.7                                | 24.7                                 |
| 8                   | 4                                            | 54                    | 89                              | 13.5                                | 22.2                                 |
| 9                   | 4                                            | 52                    | 82                              | 13.0                                | 20.5                                 |
| 10                  | 5                                            | 46                    | 85                              | 9.2                                 | 17.0                                 |
| 11                  | 2                                            | 47                    | 89                              | 23.5                                | 44.5                                 |
| 12                  | 2                                            | 38                    | 91                              | 19.0                                | 45.5                                 |

This table is to be read as follows: In paragraph 1 of Gray's Oral Reading Scale there are 7 sentences containing a total of 48 words. In reading these words orally there are 55 separate sound syllables or divisions. (See Test.) That is, the average length of a sentence is 6.9 words or 7.9 sounds.

As a whole, the table shows that the average length of the sentences in words increases irregularly from the beginning to the end of the scale; that in terms of the number of sound divisions the average length also increases irregularly.

The vocabulary also increases in difficulty from paragraph to paragraph. The various words new to each paragraph are shown in Table LXXV, between pages 304 and 305. Unfortunately, there is no information as to the relative frequency of occurrence of words in children's reading vocabularies, so that it is impossible to evaluate

TABLE LXXIV  
FREQUENCY OF OCCURRENCE OF WORDS OF DIFFERENT LENGTHS (SOUND DIVISIONS)

| PARAGRAPH<br>NUMBER | NUMBER OF SOUND DIVISIONS PER WORD |    |   |   |   |   | TOTAL<br>WORDS | TOTAL<br>SOUND<br>DIVISION | AVERAGE<br>PER<br>WORD |
|---------------------|------------------------------------|----|---|---|---|---|----------------|----------------------------|------------------------|
|                     | 1                                  | 2  | 3 | 4 | 5 | 6 |                |                            |                        |
| 1                   | 41                                 | 7  | — | — | — | — | 48             | 55                         | 1.2                    |
| 2                   | 44                                 | 5  | — | — | — | — | 49             | 54                         | 1.1                    |
| 3                   | 47                                 | 2  | — | — | — | — | 49             | 51                         | 1.0                    |
| 4                   | 51                                 | 9  | 1 | — | — | — | 61             | 72                         | 1.2                    |
| 5                   | 47                                 | 12 | — | 1 | — | — | 60             | 75                         | 1.2                    |
| 6                   | 47                                 | 13 | — | 2 | — | — | 62             | 81                         | 1.3                    |
| 7                   | 37                                 | 12 | 3 | 1 | — | — | 53             | 74                         | 1.4                    |
| 8                   | 33                                 | 11 | 6 | 4 | — | — | 54             | 89                         | 1.6                    |
| 9                   | 36                                 | 8  | 4 | 2 | 2 | — | 52             | 82                         | 1.6                    |
| 10                  | 28                                 | 7  | 4 | 5 | 1 | 1 | 46             | 85                         | 1.9                    |
| 11                  | 26                                 | 10 | 4 | 5 | 1 | 1 | 47             | 89                         | 1.9                    |
| 12                  | 16                                 | 4  | 7 | 9 | 2 | — | 38             | 91                         | 2.5                    |

This table is to be read as follows: In paragraph 1 there are 41 words which consist of a single sound and 7 words of two sound divisions each. The average number of sounds per word for paragraph 1 is 1.2. The table shows that the words in the first five paragraphs are approximately the same length, but that from the 6th paragraph on there is quite a steady increase in the length of the words, until the average length in paragraph 12 is double that in paragraphs 1 to 5.



the difficulty of the paragraphs from this point of view. However, in each paragraph the children are called upon to read 24 or 25 new words<sup>1</sup> and these words are, in general, increasingly longer and less common from paragraph to paragraph.

The analysis will not be pushed further. Enough has been said to show the incompleteness of our knowledge of the causes of the increase in difficulty from paragraph to paragraph. Nevertheless, in the opinion of the author, Gray's Scale is one of the most satisfactory of the various measuring scales and is probably as perfect as it can be made on the basis of present knowledge.

A drawback in the use of the Gray Scale is that children must be measured individually, so that the measurement of a school system requires a great deal of time. For this reason, in certain grades at Gary only selected children were measured. The method of sampling was as follows:

For all grades from two to eight inclusive the teachers of reading were asked to fill out for each child in the class a judgment card like that shown in Figure 53, page 305. In grades three, five, and seven practically all the children were tested. In the other grades 10 children were chosen from each class—the 3 given the highest marks by the teacher, the 3 lowest, and the 4 nearest the center of the class. In all 1557 children were examined.

This method of measurement by sampling is open to question. If 10 children are chosen from a class of

<sup>1</sup>Median values.

**RAGRA**

**PARAG**

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FIGURE 53  
TEACHERS' JUDGMENT CARDS

| TEACHERS JUDGMENT CARD                                                                                                                                                                                                |   | EMERSON | Reading |   |   |   |   |   |    |    |    |                       |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------|---------|---|---|---|---|---|----|----|----|-----------------------|----|----|----|----|----|----|----|----------------|--|--|--|--|--|--|--|
| Instructions; Indicate by a check mark the items on the opposite side of this card which express your judgment of the ability in reading of the pupil whose name appears below. Express the general mark in per cent. |   |         |         |   |   |   |   |   |    |    |    |                       |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
| Name of Pupil <u>Bessie Warren</u> Grade <u>8th</u>                                                                                                                                                                   |   |         |         |   |   |   |   |   |    |    |    |                       |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
| Name of Teacher <u>Mrs. Long</u> Subject <u>Reading</u>                                                                                                                                                               |   |         |         |   |   |   |   |   |    |    |    |                       |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
| The Gary Public Schools                                                                                                                                                                                               |   |         |         |   |   |   |   |   |    |    |    |                       |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
| Check the items which apply                                                                                                                                                                                           |   |         |         |   |   |   |   |   |    |    |    |                       |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
| 1                                                                                                                                                                                                                     | 2 | 3       | 4       | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13                    | 14 | 15 | 16 | 17 | 18 | 19 | 20 |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | SILENT READING        |    |    |    |    |    |    |    | ORAL READING   |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Rapid                 |    |    |    |    |    |    |    | Fluent Reader  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Average               |    |    |    |    |    |    |    | Average Reader |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Slow                  |    |    |    |    |    |    |    | Poor Reader    |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Thought Getting Power |    |    |    |    |    |    |    | EXPRESSION     |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Excellent             |    |    |    |    |    |    |    | Excellent      |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Good                  |    |    |    |    |    |    |    | Good           |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Fair                  |    |    |    |    |    |    |    | Fair           |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Poor                  |    |    |    |    |    |    |    | Poor           |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | UNDERSTANDING         |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Excellent             |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Good                  |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Fair                  |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Poor                  |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Failure               |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | RATE                  |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Rapid                 |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Average               |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Slow                  |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Thought Getting Power |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Excellent             |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Good                  |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Fair                  |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Poor                  |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                       |   |         |         |   |   |   |   |   |    |    |    | Failure               |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |
| Summary—General Ability in Reading <u>76</u> %                                                                                                                                                                        |   |         |         |   |   |   |   |   |    |    |    |                       |    |    |    |    |    |    |    |                |  |  |  |  |  |  |  |

Cards were filled out by the teachers for each individual child in grades 2 to 12. Selection of children to be measured by Gray's Oral Reading Scale was made on the basis of the marks shown on these cards. Ten children were chosen from each class, the group being composed of the three having the highest rating, the three having the lowest rating, and the four of average ability. In grades 3, 5, and 7, practically all the other children in the classes were measured as well.

40, the class will be misrepresented by the resulting score based upon the performances of the 10 children, unless the teacher's judgment is reliable. In grades three, five, and seven practically the full class membership (except for absence) was measured in each class, although the scores were tabulated in groups of 10 as in other grades. This makes it possible to determine the extent to which the method of sampling is valid.

It was found that the differences between the scores made by all the children in a class and by the selected group were small, averaging 3 points. This is less than the usual error of measurement (Table LXXVI, page 308).

The examiners at Gary were the writer and his assistants and six graduate students from Professor Gray's own classes in the University of Chicago. These latter were trained in the use of the scale by Professor Gray himself. As a further precaution a large part of the first day's scoring was done in duplicate. That is, as a child read from the scale, two examiners made independent records, and after the child had left the room the two records were compared and doubtful entries discussed.

A study of these duplicate scores makes it plain that the use of the scale leads to consistent records of children's performances. (Tables LXXVII and LXXVIII, pages 309-310). In 21 per cent. of the cases the two records agreed exactly; in 70 per cent. of the cases the differences were 2.5 points or less (about half a year's growth),

and in only 6 per cent. was the difference greater than 5 points. There were differences in the closeness of the agreement between the records of the various pairs of judges, and, in general, those who had had the most experience in the use of the scale had the most consistent records. None of the five pairs of judges had an average difference of as much as 3 points. The results may, therefore, be accepted as revealing the true abilities of the children within a half grade. In this test, as elsewhere, the class averages, as determined by two independent observers, differ by very small amounts.

In making the comparisons noted above it was found that there were often marked disagreements as to the actual mistakes made, particularly when the number of mistakes was large, but usually close agreement as to the number of mistakes. Two sets of independent records are given in Figure 54, pages 312-313. For paragraph 3, the two records agree; for paragraph 5 there is a disagreement of 2 seconds in the time records and of 1 error in the mistakes. In both will be found differences in the manner in which the mistakes were recorded. As, however, six is the maximum number of mistakes that can be made and have the performance count at all, the differences are not serious and, as has been shown, do not affect many scores. On the other hand, they invalidate the records so far as types of mistakes are concerned and no such analyses were attempted.

The method of scoring adopted by Professor Gray yields approximately constant scores from grade to grade.

## THE GARY SCHOOLS

TABLE LXXVI

VALIDITY OF MEASUREMENT BY SAMPLING

| Number Measured | Score Based on Total Measurements | Score Based on Ten Selected Cases | Difference |
|-----------------|-----------------------------------|-----------------------------------|------------|
| THIRD GRADE     |                                   |                                   |            |
| 18              | 31.9                              | 27.8                              | -4.1       |
| 31              | 30.8                              | 44.8                              | +14.0      |
| 23              | 27.5                              | 28.5                              | +1.0       |
| 26              | 27.0                              | 23.2                              | -3.7       |
| 29              | 40.5                              | 41.2                              | +0.7       |
| 21              | 34.0                              | 29.0                              | -5.0       |
| 25              | 28.7                              | 24.0                              | -4.7       |
| 32              | 31.3                              | 23.5                              | -7.8       |
| 28              | 38.7                              | 33.5                              | -5.2       |
| 36              | 38.4                              | 30.1                              | -8.3       |
| 25              | 40.4                              | 30.4                              | -9.9       |
| 16              | 37.5                              | 37.5                              | 0.0        |
| 20              | 40.8                              | 42.5                              | +1.7       |
|                 | 39.2                              | 37.8                              | -1.4       |
| FIFTH GRADE     |                                   |                                   |            |
| 30              | 43.0                              | 43.0                              | 0.0        |
| 31              | 43.0                              | 43.0                              | 0.0        |
| 31              | 43.0                              | 43.0                              | 0.0        |
| 34              | 43.0                              | 43.0                              | 0.0        |
| 23              | 43.0                              | 43.0                              | 0.0        |
| 32              | 43.0                              | 43.0                              | 0.0        |
| 34              | 43.0                              | 43.0                              | 0.0        |
| 24              | 43.0                              | 43.0                              | 0.0        |
| 30              | 43.0                              | 43.0                              | 0.0        |
| 33              | 43.0                              | 43.0                              | 0.0        |
| SEVENTH GRADE   |                                   |                                   |            |
| 30              | 45.0                              | 45.0                              | 0.0        |
| 30              | 45.0                              | 45.0                              | 0.0        |
| 25              | 41.0                              | 41.0                              | 0.0        |
| 28              | 43.0                              | 43.0                              | 0.0        |
| 20              | 43.0                              | 43.0                              | 0.0        |
| 25              | 43.0                              | 43.0                              | 0.0        |
| 30              | 43.0                              | 43.0                              | 0.0        |

This table is to be read as follows: In a certain 3rd grade class, 38 children were measured with Gray's Oral Reading Scale. The average score of the entire group was 31.9 points. The class score based upon 10 selected cases was 47.8 points. That is, the score of the class, as determined by the method of sampling, gave a score 4.4 points too low.

The table as a whole shows that there is a slight tendency for the scores of the selected group to be higher than the scores based on the measurement of the entire class. The maximum difference shown is, however, but 5.0 points. Only 61 per cent of the cases exceed 3 points. But 11 of the 30 cases show a negative difference. As a whole, therefore, results from the use of the Gray's Oral Reading Scale represent the true results within 3 points, or half a year's growth.

TABLE LXXVII  
ACCURACY OF SCORING—GRAY'S ORAL READING TEST<sup>1</sup>

| CLASS No. 8  |                  |                  |            | CLASSES 9-11 |                  |                  |            | CLASSES 14-17 |                  |                  |            |
|--------------|------------------|------------------|------------|--------------|------------------|------------------|------------|---------------|------------------|------------------|------------|
| Child Number | Score by Judge A | Score by Judge B | Difference | Child Number | Score by Judge A | Score by Judge B | Difference | Child Number  | Score by Judge A | Score by Judge B | Difference |
| 1            | 55               | 54               | +1         | 1            | 45               | 51               | -6         | 1             | 38               | 36               | +2         |
| 2            | 51               | 49               | +2         | 2            | 48               | 48               | 0          | 2             | 30               | 31               | -1         |
| 3            | 48               | 52               | -4         | 3            | 46               | 44               | +2         | 3             | 22               | 29               | -7         |
| 4            | 48               | 48               | 0          | 4            | 30               | 31               | -1         | 4             | 19               | 22               | -3         |
| 5            | 46               | 50               | -4         | 5            | 30               | 30               | 0          | 5             | 30               | 32               | -2         |
| 6            | 40               | 38               | +2         | 6            | 28               | 26               | +2         | 6             | 35               | 38               | -3         |
| 7            | 32               | 36               | -4         | 7            | 26               | —                | —          | 7             | 44               | 39               | +5         |
| 8            | 30               | 30               | 0          | 8            | —                | —                | —          | 8             | 46               | 46               | +2         |
| 9            | 26               | 36               | -10        | 9            | —                | —                | —          | 9             | —                | —                | —          |
| 10           | 25               | 19               | +6         | 10           | —                | —                | —          | 10            | —                | —                | —          |
| Average      | 40.1             | 41.2             | 1.1        |              | 37.2             | 38.3             | 1.2        |               | 33.3             | 34.1             | .9         |
| Median       | 43               | 43               | 0          |              | 37.5             | 37.5             | 0          |               | 32.5             | 34.0             | 1.5        |

<sup>1</sup>Record of three groups of children in Jefferson School, scored by two judges simultaneously but independently.

Three children were re-scored by same examiner several days after first examination. Differences between first and second measurement, A, 3 points; B, 2 points; C, 4 points.

This table is to be read as follows: In class No. 8 Jefferson School, child No. 1 was given a mark of 55 points by Judge A, 54 points by Judge B; a difference of 1 point. The average difference for the 10 children in the group was 1.1 points. The median difference was 3 points. The average scores of the group as a whole differ by 1.1 points. Median scores were exactly the same. Similar results are shown for the other groups.



TABLE LXXVIII  
 ACCURACY OF SCORING—GRAY'S ORAL READING SCALE  
 DIFFERENCE BETWEEN SCORES OF TWO JUDGES, SCORING SIMULTANEOUSLY BUT INDEPENDENTLY.

| SIZE OF DIFFERENCE<br>IN SCORE | NUMBER OF CASES WHERE THE TWO SCORES GIVEN ONE CHILD DIFFER<br>BY THE AMOUNT SHOWN |                   |                   |                   |                   |                 | PER CENT OF<br>TOTAL |
|--------------------------------|------------------------------------------------------------------------------------|-------------------|-------------------|-------------------|-------------------|-----------------|----------------------|
|                                | JUDGES<br>A AND B                                                                  | JUDGES<br>C AND D | JUDGES<br>E AND F | JUDGES<br>G AND H | JUDGES<br>I AND J | ENTIRE<br>GROUP |                      |
| 0                              | 1                                                                                  | 7                 | 10                | 4                 | 12                | 34              | 21                   |
| 1                              | 4                                                                                  | 7                 | 12                | 3                 | 10                | 36              | 22                   |
| 2                              | 0                                                                                  | 8                 | 8                 | 7                 | 9                 | 32              | 19                   |
| 3                              | 8                                                                                  | 7                 | 4                 | 2                 | 6                 | 27              | 16                   |
| 4                              | 2                                                                                  | 1                 | 3                 | 3                 | 5                 | 14              | 9                    |
| 5                              | 4                                                                                  | 3                 | —                 | 1                 | 3                 | 11              | 7                    |
| 6                              | —                                                                                  | 1                 | —                 | 2                 | 2                 | 5               | 3                    |
| 7                              | —                                                                                  | 2                 | —                 | 1                 | 1                 | 4               | 2                    |
| 8                              | —                                                                                  | 1                 | —                 | —                 | —                 | 1               | —                    |
| 9                              | —                                                                                  | —                 | —                 | —                 | —                 | —               | —                    |
| 10                             | —                                                                                  | —                 | —                 | 1                 | —                 | 1               | —                    |
| Total Cases .....              | 19                                                                                 | 37                | 37                | 24                | 48                | 165             | 100                  |
| Average Difference. . .        | 2.9                                                                                | 2.5               | 1.4               | 2.9               | 2.1               | 2.2             | —                    |
| Median Difference. ....        | 3.6                                                                                | 2.6               | 1.8               | 2.7               | 2.2               | 2.4             | —                    |

This table is to be read as follows: 19 children were scored simultaneously but independently by Judges A and B. For one child their scores agreed exactly; for 4 children the differences between the scores given by Judge A and Judge B were 1 point each; in 8 cases they were 3 points each; in 2 cases they were 4 points each; and in 4 cases, they were 5 points each. The average difference was 2.9 points. The median difference was 3.6 points. The average difference for the 165 cases was 2.2 points. In nearly 80 per cent of the cases the difference was less than 4 points.

Thus the fourth and fifth grades at Gary made an average score of 39. This does not mean that they have the same ability; it means merely that the fourth grade is as near the fourth grade standard as the sixth grade is near the sixth grade standard. To indicate the progress from grade to grade it is necessary to convert the actual scores into relative scores by adding 20 points to the second grade score and 5 points additional, the average yearly progress, for each grade above the second. In the form of graph adopted by Professor Gray this allowance is made by shifting the grade scales. If, however, the Gary grade averages were reduced to units on a single scale with an arbitrary zero point, the scores would have the values shown in Table LXXIX.

TABLE LXXIX

GARY RESULTS, GRAY'S ORAL READING SCALE, EXPRESSED IN TERMS OF A SINGLE UNIFORM SCALE

| GRADE                              | 2  | 3  | 4  | 5  | 6  | 7  | 8  |
|------------------------------------|----|----|----|----|----|----|----|
| Gary Average. ....                 | 27 | 36 | 39 | 39 | 41 | 42 | 41 |
| Gary Values on a uniform scale. .. | 47 | 61 | 69 | 74 | 81 | 87 | 91 |

In Figure 46, Section I, of this chapter the scale along the vertical axis enables the conventional graph to be read in terms of a single scale.

It will be noted that the increase in score from grade to grade is small (5 points after the second grade). The conventional method of scoring obscures this fact as all grades make nearly the same score, and within each

FIGURE 54  
 AGREEMENT AND DISAGREEMENT IN SCORING OF TWO JUDGES

JUDGE A

PARAGRAPH 3

25 seconds      3 3 mistakes

Once<sup>t</sup> there were a cat and a mouse. They lived in the same house. The cat bit off the mouse's tail. "Pray, pussie," said the mouse, "give me my long tail again."

"No" said the cat, "I will not give you your tail till you bring me some milk."

PARAGRAPH 5

62 seconds      5 12 mistakes

One of the most interesting birds which ever lived in my bird-room was a <sup>beautiful</sup> blue-jay named <sup>it</sup> Jack<sup>e</sup>. He was full of business from morning till night, scarcely <sup>ever</sup> still. He had been stolen from a nest long before he could fly, and he had been reared in a house long before he had been given to me as a pet.

JUDGE B

PARAGRAPH 3

*25 seconds*

*3 3 mistakes*

Once <sup>to</sup> there were a cat and a mouse. They lived in the same house. The cat bit off the mouse's tail. "Pray, puss," said the mouse, "give me my long tail again."

"No," said the cat, "I will not give you your tail till you bring me some milk."

PARAGRAPH 5

*60 seconds*

*5 11 mistakes*

One of the most interesting birds which ever lived in my bird-room was a blue-jay named Jackie. He was full of business from morning till night, scarcely ever still. He had been stolen from a nest long before he could fly, and he had been reared in a house long before he had been given to me as a pet.

In paragraph 5, although the actual number of mistakes recorded differs but 1, the errors recorded are differently marked.

grade the range of scores is large. For instance, in Froebel class No. 44 (seventh grade) the lowest individual score was 20, the highest 52. There were 4 scores in the twenties, 6 in the thirties, 16 in the forties, and 2 in the fifties. In other words, the individual scores show a range of variation equal to more than six times the average yearly progress, yet the maximum difference between the scores of the 24 seventh grade groups (of approximately ten children each) examined was 10.4 points. In other words, differences between scores of classes and of cities are much more significant than differences between individuals. The differences between the Gary and Grand Rapids scores, for instance, may be transformed into years of difference by dividing by 5. Whether or not differences between individual scores may be similarly transformed must await the evaluation of the results of repeated measurement of the same individual children from grade to grade.

#### REPRODUCTION TESTS

The reading and reproduction tests, as already pointed out, measure, on the one hand, rate of reading, and, on the other, a complex ability made up mainly of three elements—ability to comprehend something of what was read, ability to remember the same for several minutes while engaged in reproducing it, and ability to organize the words and ideas remembered into a connected story. Ability to read must be credited with a minor part in determining a child's score.

The rate of reading in itself is probably not a significant measure of anything. The range of variable performance is so large that rate scores in such tests as were given at Gary are mere symptoms, that is, slight changes in the conditions or incentives to reading effort produce large variations. Inferences from symptoms are reliable only when the conditions which cause variation in the symptom are known. For instance, the rate of silent reading at Gary appears low in comparison with results from similar tests in other cities. So far as is known, there is nothing in the tests and the testing conditions which would cause this variation, and the results from two or three trials of different tests are consistent. Yet the same tests, as has been pointed out, bring to light very large individual variations. The causes of these are not known. The reader must be careful, therefore, to remember that while every precaution has been taken to make the data reliable, there is so much to be learned about reading ability that later investigations may prove present conclusions to have been unwarranted.

Analysis of the reproductions, item by item, affords an opportunity for showing the manner in which the factor of memory operates. Certain subdivisions of the story were recalled by nearly all who read them. These elements form the gist of the story. Within each subdivision, however, there is marked decline of the frequency with which the various items were recalled, and, in general, the longer an item has to be remembered the less frequently it is recalled. That is, only children

TABLE LXXX  
RECALL IN READING AND REPRODUCTION TESTS

| THOUGHTS <sup>1</sup> | TIMES<br>READ | TIMES<br>RECALLED | PERCENTAGE<br>OF RECALL | THOUGHTS | TIMES<br>READ | TIMES<br>RECALLED | PERCENTAGE<br>OF RECALL |
|-----------------------|---------------|-------------------|-------------------------|----------|---------------|-------------------|-------------------------|
| A                     | 118           | 115               | 97.5                    | N        | 46            | 17                | 86.9                    |
| B                     | 118           | 89                | 75.4                    | O        | 40            | 22                | 55.0                    |
| C                     | 117           | 70                | 59.8                    | P        | 36            | 20                | 55.6                    |
| D                     | 117           | 71                | 60.7                    | Q        | 82            | 6                 | 18.8                    |
| E                     | 117           | 52                | 44.4                    | R        | 80            | 14                | 46.7                    |
| F                     | 115           | 45                | 39.1                    | S        | 24            | 8                 | 33.3                    |
| G                     | 112           | 15                | 13.4                    | T        | 21            | 14                | 66.7                    |
| H                     | 111           | 99                | 89.2                    | U        | 12            | 4                 | 33.3                    |
| I                     | 89            | 83                | 93.3                    | V        | 11            | 5                 | 45.5                    |
| J                     | 77            | 46                | 59.7                    | W        | 9             | 8                 | 88.9                    |
| K                     | 66            | 21                | 31.8                    | X        | 3             | 2                 | 66.7                    |
| L                     | 64            | 39                | 60.9                    | Y        | 2             | 0                 | 0                       |
| M                     | 52            | 19                | 36.5                    | Z        | 2             | 2                 | 100.0                   |

<sup>1</sup>A. Fred came down late to breakfast one morning.  
B. All the other members were through and had gone about their duties.

C. (He) was still sleepy.

D. For he had stayed up until twelve o'clock the night before.

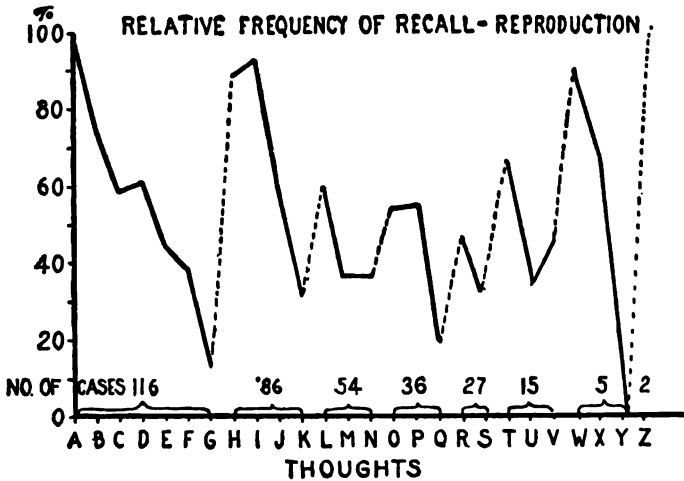
E. He was usually in bed by nine.

F. He was cross.

G. As most boys.

This table is to be read as follows: Thought A was read by 118 children, it was recalled in whole or in part 115 times. Percentage of recall 97.5. Above are given in very brief form the items of the thoughts which are recalled most frequently. It will be seen that taken together they express the important elements of the story. For analytical key and method of scoring, see IX of Appendix A, page 443.

FIGURE 55  
RELATIVE FREQUENCY OF RECALL



The scale along the base of the figure represents the various thought divisions in the key for scoring the reproduction test. The scale along the left hand vertical axis shows the per cent. of recall. "Number of cases" shows the average number of children recalling each of the thought groups. The grouping is on the basis of connected thoughts. For instance, thought divisions A, B, C, D, E, F, and G all have to do with the fact that Fred was late to breakfast. Solid lines show the relative frequency of recall for the various thoughts within each division.

It should be noted that some thoughts are of more importance than others, that in general, the first thought in each division is the important one. The figure, as a whole, illustrates the part memory plays in determining the material reproduced.



with exceptional memories will reproduce the minor items of any main thought (Table LXXX, page 316, Figure 55, page 317).

A careful analysis was made of the data from one of the major subdivisions, thoughts A to G, which tell about Fred's coming late to breakfast and the reason for his tardiness. Within each thought the items were further classified into groups on the basis of percentage of recall (Table LXXXI, between pages 318 and 319). A study of these results shows that it is the modifying ideas and the unusual words or unusual forms of expression which are forgotten or avoided. For instance, subdivision B was the sentence: "So late, that all the other members of the family were through and had gone about their respective duties," and subdivision E: "Whereas he was usually in bed by nine." Only 26 per cent. of the children who reproduced some portion of thought B wrote "respective," and but 31 per cent. of those who reproduced some part of thought E wrote "whereas." It would be pure assumption to say that only those who understood the meaning of these words reproduced them. Absolute proof is lacking that the selective action evident in the table may be attributed to memory, but the evidence is sufficiently clear to make it proper to question reproduction scores as measures of reading ability.

#### RELATIVE RATES OF ORAL AND SILENT READING

Closely connected with the measurement of rate of reading is the comparison of the rate of oral with the

rate of silent reading. Such a comparison, however, is probably something quite different from what it appears to be. Rate of oral reading is based upon the number of words read per unit of time, and rate of silent reading is based upon the number of words read per unit of time. In words these two statements appear to mean the same thing, but account must be taken of the differences in the activities connoted by the word "read." In oral reading, a word read means a word sounded; in silent reading, a word is read when it has been passed in the course of the reading activity. These two methods of reading have in common the movement of the eyes by which the various words are brought into view one after another, but in oral reading the limiting factor is the rapidity with which the words can be voiced, a muscular reaction, and in silent reading the limiting factor is the rapidity with which the words seen can be comprehended, a mental activity. The two activities really have nothing in common that may properly be compared, and the comparison is valid only in the sense of comparing the total material covered in a given time. For this purpose the word is as good a unit as any so long as the material is unselected, so that the average length of word is constant. But for Gray's Scale the average length of word is not constant. It varies from 3.3 letters per word in paragraph 1 to 6.7 letters per word in paragraph twelve. In terms of syllables, or, better, "sound divisions," the average varies from 1.04 per word in paragraph 3 to 2.5 in paragraph

12. Moreover, the various sound divisions vary in length depending upon their position in the sentence and the necessity of prolonging them in critical positions to give the proper expression in reading. The number of pauses that must be made between sentences also affects the rate at which the oral reading activity proceeds. The word is, therefore, very far from being a proper unit in which to express rate of oral reading when attempting to measure the rate at which the activity itself proceeds. For this reason, Gray's statement that "as the subject matter to be read increases in difficulty the rate of reading is decreased, although no errors may be made" is not true in so far as it rests upon the evidence of increasing time to read the more difficult paragraphs. For it is quite impossible to read paragraphs 2 and 12 even after thorough study and preparation at such rates that their times will be proportional to the number of words they contain, provided both are read "naturally." For instance, the writer's time to read the 49 words of paragraph 2 was 11.7 seconds, and for paragraph 12, which contains a smaller number of words (38), was 16.3 seconds. Expressed in terms of sound divisions the ratio of the two times would be 1.68, actually it is 1.39. The disagreement is due to the fact that allowances must be made for the number of pauses. The curve for the rate of oral reading based upon words read per minute is not a curve which expresses in any way the rate of development in the rate at which oral reading activity proceeds, unless in every

case the identical material is read. For this reason the curve in Figure 45 is based upon the average rate for paragraphs 1 and 2 in every grade. The curve is valid, therefore, for this material alone and may not represent the general development for rate of oral reading.

Neither is the rate of silent reading in words per minute a measure of that activity. The critical factor in determining the rate of silent reading is the number and character of the eye shifts or pauses. Material is not read word by word. The length of a word has little to do with the rapidity with which it is perceived. The number of words read per minute of time is not a measure of the activity itself, only of its results. The curve for silent reading, therefore, does not represent the rate of development of that activity. It is extremely probable that when suitable studies have been made so that true development curves for these two rates of reading may be compared, the conclusions will be quite different from those suggested by the present rates of reading.

For the present, the reader should understand that the two curves shown in Figure 47, page 278, yield a comparison merely of the amount of material read in a given time. Such a comparison has a diagnostic value, however, for if children in one school system show relatively less difference between the amount of material covered in a given time in oral and silent reading than children in other schools, it indicates a difference in the relative efficiency of the development of the two processes. However, nothing is known in regard to the way these curves would

be altered by a change of material. The curves of other investigators have been based upon different material. Whether or not this alone is responsible for the differences in the Gary scores is not known. The Gary curves seem to represent a real and an unsatisfactory condition, but the reader should keep in mind the possibility (although not the probability) that the effect noted is due wholly to the use of faulty units of computing rate of reading.

In this connection a second possibility must be considered, the manner in which the rate of reading is computed. Gray used the harmonic mean<sup>1</sup> in determining rate instead of the arithmetic mean, or the median used by Brown, Oberholtzer, Whipple, Curtis, and other investigators. The harmonic mean usually yields a smaller result, as Gray himself points out. The Gary rates are medians of actual rates. That is, in the Gary determinations of both oral and silent reading, the actual number of words read per minute by each child was computed from the time and the total words read, and the median of these rates was taken as the class score. In Gray's work, however, the times required to read one hundred words were averaged and the rate computed on the basis of the average time.

An illustration will make the difference clear. For instance, if

|         |      |           |    |             |    |           |    |          |
|---------|------|-----------|----|-------------|----|-----------|----|----------|
| Child A | read | 160 words | in | 45 seconds, | or | 213 words | in | 1 minute |
| " B     | "    | 105       | "  | 45          | "  | 140       | "  | 1        |
| " C     | "    | 150       | "  | 45          | "  | 200       | "  | 1        |
| " D     | "    | 289       | "  | 45          | "  | 385       | "  | 1        |
| " E     | "    | 122       | "  | 45          | "  | 163       | "  | 1        |

<sup>1</sup>Gray, W. S., *Studies of Elementary School Reading through Standard Tests*, p. 105.

the average rate would be 220 words per minute.<sup>1</sup> But from the same record it might be computed that

|          |            |              |              |
|----------|------------|--------------|--------------|
| Child A  | would read | 100 words in | 28.1 seconds |
| " B      | " " " "    | " "          | 42.9 "       |
| " C      | " " " "    | " "          | 30.0 "       |
| " D      | " " " "    | " "          | 15.6 "       |
| " E      | " " " "    | " "          | 36.9 "       |
| All five | " " 500    | " "          | 153.5 "      |

and the average time to read one hundred words, all five children reading simultaneously each his share, would be 30.7 seconds.

If now the number of words that would be read in one minute is computed from the average time, the rate becomes 195 words per minute instead of 220 words per minute as above. Gray's rates of silent reading are, therefore, probably lower than other rates because of this difference in the method by which they are computed. The differences, that is, are favorable to Gary, and the maximum difference<sup>2</sup> would amount to about nine words. The effect of this factor is probably negligible. However, the reader should note that the Gary results are presented as the central tendencies of the actual rates of reading (that is, the rate which is the most representative of the group) and not the time that would be required by the class to read the paragraph if each member of the class were to read a part, all reading for the same length of time, each at his own rate.<sup>3</sup>

<sup>1</sup>Median rate, 200 words per minute.

<sup>2</sup>Judging from the data given on p. 113 of Gray's *Monograph*.

<sup>3</sup>See also *Seventeenth Yearbook, National Society for the Study of Education*, page 125.

## KANSAS SILENT READING TESTS

The Kansas Silent Reading Tests are of value because they measure a type of ability that is extremely important in life, the ability to base action upon judgments in situations, information in regard to which has been obtained wholly through reading. The complex—reading judging, acting—brings into play a great number of separate abilities, very few of which are the direct products of classroom training in reading.

As the Kansas Reading Tests measure the performance of individuals only in specific situations, any score based upon a single phase of the performance is incomplete. Accordingly, the Kansas Tests were scored also for amount attempted. In order that such rate scores might be comparable with the conventional results, the assigned values for each exercise were used as a basis. That is, a child's rate score was found by adding the assigned values of every exercise for which the child wrote an answer, whether the answers were right or not. Then, in certain grades, for each child the relation between the conventional score and the rate score was expressed as a rate per cent. The Kansas Reading Tests thus yielded three sets of scores: (1) rate score, the number of points completed in a given time; (2) conventional score; the number of points allowed for correct answers; and (3) accuracy scores, the per cent. of the points attempted that were right.

In most of the grades the accuracy scores were found

TABLE LXXXII

COMPARATIVE RESULTS OF THREE TRIALS OF THE KANSAS SILENT  
READING TESTS<sup>1</sup>

| TEST III                | MEDIAN | MEDIAN DEV. | TOTAL RANGE |
|-------------------------|--------|-------------|-------------|
| Reg. Score Trial 1. . . | 23.2   | 2.7         | 12.3- 28.6  |
| " " " 2. . .            | 17.9   | 4.8         | 4.6- 30.3   |
| " " " 3. . .            | 21.8   | 4.9         | 7.0- 40.4   |
| Rate Trial 1. . . . .   | 27.3   | 4.8         | 14.2- 41.0  |
| " " 2. . . . .          | 22.3   | 3.9         | 15.4- 39.5  |
| " " 3. . . . .          | 29.9   | 4.9         | 16.4- 40.4  |
| Accuracy Trial 1. . .   | 86.0   | 9.0         | 38.0-100    |
| " " 2. . . . .          | 83.0   | 10.0        | 30 -100     |
| " " 3. . . . .          | 80.0   | 10.0        | 20 -100     |

COEFFICIENT OF CORRESPONDENCE

| Comparison of                                |  |  |     |
|----------------------------------------------|--|--|-----|
| Reg. Score Test 1 with Reg. Score 2. . . . . |  |  | 40% |
| " " " 1 " " " 3. . . . .                     |  |  | 36% |
| " " " 2 " " " 3. . . . .                     |  |  | 45% |
| Rate Test 1 " Rate " 2. . . . .              |  |  | 60% |
| " " 1 " " " 3. . . . .                       |  |  | 57% |
| " " 2 " " " 3. . . . .                       |  |  | 57% |
| Accuracy Test 1 " Acc. " 2. . . . .          |  |  | 48% |
| " " 1 " " " 3. . . . .                       |  |  | 38% |
| " " 2 " " " 3. . . . .                       |  |  | 31% |

<sup>1</sup>Based on the scores of 48 eighth grade pupils.

This table is to be read as follows: 40 per cent. of the 48 eighth grade children were found to have maintained the same position in the group within one unit of variability when the conventional scores from Test I were compared with the conventional scores from Test II. The table shows that the correspondence is greatest between rate scores or scores for number of points attempted in a given time, and lowest for the accuracy scores, or the per cent. the points right were of the points attempted.



TABLE LXXXIII  
VARIATIONS IN INDIVIDUAL SCORES IN REPEATED MEASUREMENTS—KANSAS SILENT READING TESTS

|                    | RATE SCORES |      |      | ACCURACY SCORES |    |     | CONVENTIONAL SCORES |      |      |
|--------------------|-------------|------|------|-----------------|----|-----|---------------------|------|------|
|                    | TEST        |      |      | TEST            |    |     | TEST                |      |      |
|                    | I           | II   | III  | I               | II | III | I                   | II   | III  |
| Individual A. .... | 23.8        | 15.4 | 20.7 | 52              | 30 | 100 | 12.3                | 4.6  | 20.7 |
| " B. ....          | 20.7        | 26.3 | 20.7 | 100             | 96 | 100 | 20.7                | 26.3 | 20.7 |
| " C. ....          | 27.3        | 30.3 | 40.4 | 87              | 90 | 100 | 23.8                | 27.3 | 40.4 |
| Entire Group. .... | 27.3        | 22.3 | 29.9 | 85              | 83 | 80  | 23.2                | 17.9 | 21.8 |

This table is to be read as follows: Individual A, a child in the eighth grade attempted 23.8 points in Test I, 15.4 points in Test II, and 20.7 points in Test III. His accuracy of work in Test I was 52 per cent., in Test II—30 per cent., and in Test III—100 per cent. That is, he received a credit of 12.3 points for right answers in Test I, 4.6 points in Test II, 20.7 points in Test III. The scores made by the entire group of 42 eighth grade children are shown in the last line of the table. It will be noted that Test II is quite a little harder and Test III a little easier than Test I.

by the approximate method adopted for the arithmetic tests. The record sheet was so arranged that the mere entry of the rate and conventional scores indicated the accuracy score without computation. As no comparable data are available, it was not thought necessary to determine the size of the error in such short cut tabulations. It cannot be large and the method was used consistently. Small errors would have no influence in the general conclusions.

As affording a slight indication of the reliability of the Kansas Tests, the coefficients of correspondence were computed for scores of the 42 eighth grade children present in all tests. The correspondence is greater for the rate scores than for either the accuracy or the conventional scores. A little more than half the children maintain the same relative position in the group within about 5 points for rate of work, while only approximately a third of the group maintain the same relative positions within 10 per cent. for accuracy and 5 points for the conventional score. (Table LXXXII, page 325.)

These results mean that a single measurement of a child with the Kansas Tests does not yield very reliable information in regard to his abilities. He may do very much better or very much worse in a second measurement with a different test (Table LXXXIII, page 326). How much of this variation is an indication of the inefficiency of training and how much of it is due to the defects of the tests themselves cannot be told at present.

The Kansas Reading Tests are interesting as throwing some light on the ability of the Gary children to solve the conventional arithmetical problems. The exercises of this character are as follows:

TEST I, EXERCISE XI

"We planted three trees in a row. The first one was nine feet tall and the last one was three feet shorter than the first one. The middle one was two feet taller than the last one. How tall was the middle one?"

(Assigned value, 2.2. Per cent. of eighth grade children missing, 28. Number of cases, 121.)

TEST I, EXERCISE XV

"Fred has eight marbles. Mary said to him: 'If you will give me four of your marbles, I will have three times as many as you will then have.' How many marbles do they both have?"

(Assigned value, 4.8. Per cent. of eighth grade children missing, 44. Number of cases, 48.)

TEST II, EXERCISE XIII

"If it takes a man an hour to walk around a square, each side of which is a mile in length, how long will it take him to walk eight miles?"

(Assigned value, 4.3. Per cent. of eighth grade children missing, 44. Number of cases, 16.)

TEST III, EXERCISE III

"I have five plums and Mary has four plums. Jane comes along and we see that she hasn't any. . . . We wanted to divide with Jane in such a way that we shall all three have the same number. I give Jane two plums. How many must Mary give her?"

(Assigned value, 3.5. Per cent. of eighth grade children missing, 9. Number of cases, 131.)

TEST III, EXERCISE V

"A, B, C and D in the straight line represent four places lying in a straight line. From A to B is four miles, from C to D is seven miles, from A to D is fourteen miles. How far is it from B to C?"

A————B————C————D

(Assigned value, 3.8. Per cent. of eighth grade children missing, 34. Number of cases, 125.)

TEST III, EXERCISE VIII

"There are three horizontal lines; the first is three inches in length, the second two inches, the third one inch. We know that if the second and third lines are joined end to end the resulting line will be as long as the first line. Suppose that the first and second lines are joined end to end. How many times as long as the third line will the resulting line be?"

(Assigned value, 4.8. Per cent. of eighth grade children missing, 29. Number of cases, 82.)

It will be observed that all of these are simple problems as far as the numerical relations are concerned. Exercise VIII contains a great many words, but in the others the problems are clearly stated, and the situations are within the experiences of the children. In Tests I and II the arithmetical problems come so late in the test that but relatively few of the children get to them and these, of course, are either the more able members of the class or those who worked at high rate with low accuracy. In Test III, however, practically the full class membership attempted problems 3 and 5. (Table LXXXIV, page 332.) For Test III two other exercises which are non-mathematical have been included for comparison. For instance, number 4 was: "In the following words, find one letter which is contained in only three of them, and then cross out the word which does not contain that letter":

|     |       |      |       |
|-----|-------|------|-------|
| ail | thief | live | anvil |
|-----|-------|------|-------|

The results show conclusively that many of the Gary eighth grade children are unable to solve simple arithmetical problems when presented in printed form and under test conditions (average accuracy, 6 problems, 69 per cent.). On the other hand, it must be remembered that the Gary eighth grade scores in the Kansas Test are almost exactly at the Kansas standard, which is also the score made by many eighth grade classes in other cities.

Comparative data for the number missing on the different exercises of the test are lacking. It may well be that the Gary children do as well with such problems as the children in the conventional schools. However, the results are presented for their absolute, not their comparative, value. The reader must judge for himself, therefore, whether the conditions revealed by the data above and in the tables are satisfactory.

To the writer the results seem poor, but whether the difficulty is caused by poor training in reading or in arithmetic he cannot tell. He prefers, therefore, to take the position that reasoning ability in arithmetic has not been measured at Gary, and to terminate this discussion with the repetition of the statement that the eighth grade children do as well in the Kansas Reading Tests as the children in many other cities.

#### TRABUE LANGUAGE SCALES

The Trabue Language Scales measure a very complex ability. Their author makes no claim that they measure reading ability, but they are classed with the reading tests because reading ability is one factor in determining a child's score. However, for these tests as for the Kansas Tests, while a child who cannot read cannot make a high score, a low score does not necessarily mean inability to read.

If a child scans such a sentence as "The sky — blue," the word "is" rises to consciousness spontaneously. The test is, therefore, in one aspect at least, a measure

TABLE LXXXIV  
CHILDREN MISSING CERTAIN EXERCISES IN THE KANSAS SILENT READING TESTS

| GRADE | EXERCISE XI                            |                            |                      |                                        | EXERCISE XV                |                      |                                        |                            |
|-------|----------------------------------------|----------------------------|----------------------|----------------------------------------|----------------------------|----------------------|----------------------------------------|----------------------------|
|       | NUMBER OF CHILDREN ATTEMPTING EXERCISE | NUMBER OF CHILDREN MISSING | PERCENTAGE OF ERRORS | NUMBER OF CHILDREN ATTEMPTING EXERCISE | NUMBER OF CHILDREN MISSING | PERCENTAGE OF ERRORS | NUMBER OF CHILDREN ATTEMPTING EXERCISE | NUMBER OF CHILDREN MISSING |
| 4     | 87                                     | 69                         | 79                   | 8                                      | 8                          | 100                  | 8                                      | 100                        |
| 6     | 118                                    | 62                         | 53                   | 29                                     | 21                         | 72                   | 21                                     | 72                         |
| 8     | 121                                    | 34                         | 28                   | 48                                     | 21                         | 44                   | 21                                     | 44                         |
| 12    | 20                                     | 8                          | 15                   | 0                                      | 0                          | 0                    | 0                                      | 0                          |

Exercise XI, per cent. missing, 6th grade, Beveridge 53% Emerson 55% Froebel 40%  
Exercise XI, per cent. missing, 8th grade, Beveridge — Emerson 25% Froebel 41% Jefferson 17%

Exercise XIII. Total 8th grade attempts 16, total errors 7, per cent. missing 44%. Froebel 100%, Emerson 50%, Jefferson 0.

For explanation of the manner in which the table is to be read, see page 331.

TEST III

| EXERCISE | GRADE 8                       |                  |                     | GRADE 12                      |                  |                     |
|----------|-------------------------------|------------------|---------------------|-------------------------------|------------------|---------------------|
|          | NUMBER OF CHILDREN ATTEMPTING | NUMBER OF ERRORS | PER CENT. OF ERRORS | NUMBER OF CHILDREN ATTEMPTING | NUMBER OF ERRORS | PER CENT. OF ERRORS |
| II       | 132                           | 6                | 5                   | 48                            | 4                | 8                   |
| III*     | 131                           | 12               | 9                   | 48                            | 4                | 8                   |
| IV       | 128                           | 29               | 23                  | 48                            | 2                | 4                   |
| V*       | 125                           | 42               | 34                  | 47                            | 4                | 8                   |
| VIII*    | 82                            | 24               | 29                  | 40                            | 5                | 13                  |

\*Average eighth grade results, Exercises 3, 5, and 8: Froebel 28%, Emerson 24%, Jefferson 17%, missing.

This table is to be read as follows: 87 fourth grade children attempted Exercise No. 11 in Test No. 1 of the Kansas Silent Reading Test, 69 children made mistakes. That is, 79 per cent. of all the children who attempted the exercise were unable to write the correct answers.

The results as a whole show that the number of children missing the various exercises is large, and that of the different schools the children in the Jefferson school consistently made fewer mistakes than any of the others.



of a person's habits of association in connection with the use of words. When, however, one reads, "One ought to — great care to — the right — of —, for one who — bad habits — it — to get away from them," much more ability is required to fill the blanks correctly than the mere possession of a given set of habitual associations, for the sentence has been so mutilated that there are few significant words to act as stimuli. "Take" or "exercise" suggests itself readily for the first blank, because "take care" is both said and heard frequently by all; but "right" is absolutely meaningless without some further cue, as it occurs with all sorts of words. So with certain others of the blanks. "Habits," however, stirs up a host of associations, and "get away from them" suggests habit formation and habit correction. With this cue as a basis, the intelligent child with sufficient initiative can go back to the other blanks and supply experimentally a whole series of words until a set is found which "makes sense." This, however, involves the exercise of several new ranges of information and power. In short, in these tests, reading is a very small factor and general intelligence (i. e. the ability to comprehend a situation and to bring all one's resources to bear upon it in an efficient manner in order to make an adjustment in it which shall fulfill a desired end) is the critical factor. Perhaps the best statement that can be made is that of the author: "Nothing is known about what the tests measure, except that in some way success is related to language work in school, and

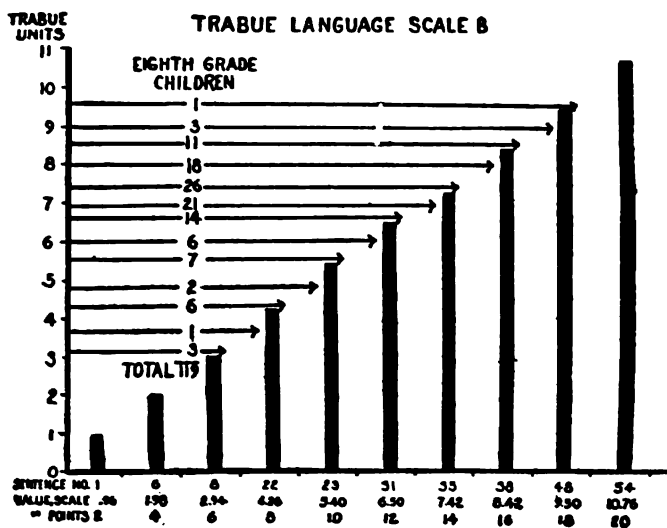
scores in the tests show a high correlation with general ability."

The sentences composing the tests have been so chosen for difficulty that each is (approximately) as much easier than the one after it as it is more difficult than the one before it.<sup>1</sup> In other words, the difficulty increases by unit amounts from sentence to sentence. A child's score in the test is not the amount done, but the difficulty of the hardest sentence he is able to complete. This fact is somewhat obscured by the method of scoring, which allows two points for each perfect answer and one for imperfect but not incorrect answers; yet, in general, if a child completes five sentences and receives a score of 10, the scores should be interpreted to mean that the child's development in ability to complete sentences has reached 10 in an absolute scale ranging from zero to 20. Thus, the test serves to sort children into groups on the basis of their development. In the eighth grade at Gary, measured with Scale B, there were three children whose maximum ability was 6 units, one child whose maximum ability was 7 units, six children of 8 units ability, two children of 9 units ability, seven children of 10 units ability, six of ability 11, fourteen of ability 12, twenty one of ability 13, twenty six of ability 14, eighteen of ability 15, eleven of ability 16, three of ability 17, and one of

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<sup>1</sup>For the details in regard to the tests and the methods by which the values of the different sentences were determined, the reader is referred to Teachers College, Columbia University, Contributions to Education No. 77.

FIGURE 56  
RESULTS OF MEASUREMENT WITH TRABUE LANGUAGE SCALE



The sentences of different difficulty serve to sort the children on the basis of ability. The relative difficulty of the various sentences composing the tests represented by the lengths of the row of rectangles. The scale along the vertical axis shows the value of these lengths in terms of Trabue units. The figures on the arrows show the number of the 119 eighth grade children tested who were able to complete each sentence, but not the next higher sentence. That is, 3 children were able to complete successfully the third sentence, but failed on the fourth and all sentences thereafter.

The graph makes clear the great range of ability found in the eighth grade. This condition is not peculiar to Gary, however.

ability 18 (Figure 56, page 336). That is, the 119 eighth grade children tested range in ability from Trabue's sixth grade standard to abilities higher than the twelfth grade standard.

With the Trabue Scales, as with most of the other tests, the individual variation within a grade is very large, while the increase in score from grade to grade is very small (average, grades three to nine, 1.4 points). A year of school work produces very little change in the group ability, yet within any one class individual children vary almost from one extreme to the other. Therefore, the exact interpretation to be placed upon results from Trabue's Scale is a matter of some doubt. It is probable that they should be considered as affording a reliable basis for comparing the general intelligence or intellectual development of groups of children.

At Gary Scales B and C were given and scored under the standard conditions set up by Trabue. Scales D and E were also given, but the time allowance was reduced from seven minutes to two minutes. It was thought that in this time a few of the brighter children would finish, but that most of the children would still be writing. That is, the attempt was made to change the test from a difficulty test to a rate test. The resulting grade scores were, however, but very slightly reduced, so that in effect there were four measurements of the Gary children with the Trabue Tests. An inspection of Table LXX, Section I, page 294, of this chapter will show that the grade scores are remarkably constant. That is, a single

## THE GARY SCHOOLS

TABLE LXXXV

COMPARATIVE RESULTS OF DIFFERENT TRIALS OF TRABUE LANGUAGE SCALES<sup>1</sup>

| TESTS IV     | MEDIAN | MEDIAN DEVIATION | TOTAL RANGE |
|--------------|--------|------------------|-------------|
| Trial B..... | 13     | 2                | 6-16        |
| " C.....     | 13     | 2                | 8-18        |
| " D.....     | 12     | 2                | 8-17        |
| " E.....     | 12     | 1                | 5-16        |

## RATE AND ACCURACY FOR D AND E

| TRIAL | MEDIAN |          | MEDIAN DEVIATION |          | TOTAL RANGE |          |
|-------|--------|----------|------------------|----------|-------------|----------|
|       | RATE   | ACCURACY | RATE             | ACCURACY | RATE        | ACCURACY |
| D     | 16     | 75       | 2.24             | 8        | 12-20       | 50-100   |
| E     | 16     | 78       | 2.41             | 11       | 10-20       | 36-100   |

PERCENTAGE OF TOTAL CASES WHICH DO NOT VARY MORE THAN ONE UNIT OF VARIABILITY

|   | B  | C  | D  | E  |
|---|----|----|----|----|
| B | —  | 55 | 62 | 38 |
| C | 55 | —  | 69 | 50 |
| D | 62 | 69 | —  | 48 |
| E | 38 | 50 | 48 | —  |

D and E accuracy 45%

D and E rate 86%

<sup>1</sup>Based on scores of 48 eighth grade pupils.

This table is to be read as follows: 55 per cent. of the 42 eighth grade children maintain the same relative position when tested with Scale B as with Scale C, within one unit of variability (2 points of score). The correspondence between scores from Scale B on a seven minute basis and Scale D on a two minute basis was greater, being 62 per cent., but between Scale B and Scale E was less, being but 38 per cent. The correspondence between scores for number of points attempted in Scale D and E was 86 per cent. but the correspondence for scores for accuracy of work was but 45 per cent.

test by means of any one of the four scales yields a reliable measure of the group. The Gary generalized scores, being based upon the four trials, may therefore be accepted as accurately reflecting the abilities of the Gary children.

The results of the repeated test throw light upon the question of the reliability of the individual scores. The coefficients of correspondence between the scores determined from the various scales were found (Table LXXXV, page 338). In general, approximately half the children will, in successive tests, maintain the same relative position within the group. When the tests are given with a two minute time allowance, 86 per cent. of the children will maintain the same position in two trials as far as rate scores are concerned, but only 45 per cent. as far as accuracy scores are concerned. In other words, the high correlations which exist between the conventional Trabue scores and the other general measures of ability in school work are probably due to the fact that maximum scores are determined more by general intelligence than by specific abilities.

The scoring of the Trabue Tests presents an interesting and difficult problem. The relative difficulty of the different sentences was determined on the basis of the responses made by children when given tests of about 56 sentences at a time. In the form used at Gary each test consists of but ten sentences. It is extremely probable that the relative values of the sentences would be affected by this change, but how much is not known.<sup>1</sup>

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<sup>1</sup>See page 296, footnote.

A second peculiar point is the question of whether or not a sentence has the same value to one who cannot complete it at all, to one who can just complete it, or can complete it only after effort, and to one who can complete it easily. Under the standard conditions such problems do not arise, as the time limit is from three to four times as long as is necessary for all the children in the upper grades to try all the problems once. But under the shortened time allowance, the question of the amount of credit to be given for each sentence is an important one. For the Gary tabulations the scores for number of sentences tried were based on the regular allowance of 2 points per question. The conventional score was taken as points right and the accuracy score as the relation between the points attempted and the points right. If the sentences are considered to increase in difficulty, however, it would probably have been better to have computed a cumulative score for attempts and rights; that is, allow 2 points for the first question answered and 4 for the second and so on. The sum of all the points attempted would then be the rate score and the per cent. the points right were of the points attempted would be the accuracy score.<sup>1</sup> However, as it was desired to make comparisons between the scores for Scales C and D, and Scales D and E, the conventional method was used as a basis of scoring in both cases.

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<sup>1</sup>The coefficient of correspondence for 42 eighth grade scores in Scales D and E figured on this basis was .43 per cent. for rate and .55 per cent. for accuracy (one unit of variability).

A tabulation of the rate and accuracy scores of 42 eighth grade children in the four trials of the tests was made to show the differences in the conditions under which the children were tested for the different scales. In Tests B and C about 80 per cent. of the children wrote something for every question, but very much of what was written beyond a certain point was incorrect. The median accuracy of the group is about 70 per cent. In Tests D and E, however, each child had time to reach the sentences which were difficult for him, yet not time enough to puzzle out answers that did not readily suggest themselves. The median accuracy is about 5 per cent. higher. But 7 per cent. of the children were able to finish all the sentences, and the remaining children are shown in positions which reflect their relative rates of work as well as the difficulty of the sentences they are able to complete in the given time (Table LXXXVI, pages 342-343).

The point of the data in the tables is that any consideration of what the results mean must take into account the fact that the conventional Trabue scores are scores of maximum achievement. They tell nothing about the relative efficiency with which the results have been achieved. If the results seem more constant than in other tests, it is because the conditions under which they are given are so controlled as deliberately to ignore those important phases of a child's work which differentiate him from other children, such phases as result in differences in the rate at which he works and in the quality of his output.



TABLE XXXVI

## COMPARATIVE DISTRIBUTIONS OF RATE AND ACCURACY: THAMAR LANGUAGE B-12

Scales B and C had a seven minute time allowance. The scales D and E, a two minute time allowance. By rate is meant the total points allowed for every sentence in which any attempt was made to write an answer; by accuracy is meant the percentage the conventional score for sentence completed correctly in a rate score.

| SCALE B     |    |    |    |    |    |    | SCALE C     |          |    |    |    |    |    |    |       |
|-------------|----|----|----|----|----|----|-------------|----------|----|----|----|----|----|----|-------|
| POINTS DATA |    |    |    |    |    |    | POINTS DATA |          |    |    |    |    |    |    |       |
| Accuracy    | 10 | 12 | 14 | 16 | 18 | 20 | Total       | Accuracy | 10 | 12 | 14 | 16 | 18 | 20 | Total |
| 100%        |    |    |    |    |    |    |             | 100%     |    |    |    |    |    |    |       |
| 95          |    |    |    |    |    | 8  | 1           | 95       |    |    |    | 1  |    |    |       |
| 90          |    |    |    |    |    | 7  | 6           | 90       |    |    |    |    |    |    |       |
| 85          |    |    |    | 1  | 1  | 6  | 9           | 85       |    |    |    |    |    |    |       |
| 80          |    |    |    | 1  | 1  | 6  | 7           | 80       |    |    |    | 1  |    |    |       |
| 75          |    |    |    | 1  | 1  | 6  | 7           | 75       |    |    |    |    |    |    |       |
| 70          |    |    |    |    | 1  | 2  | 3           | 70       |    |    |    |    |    |    |       |
| 65          |    |    |    |    | 1  | 2  | 3           | 65       |    |    |    | 2  |    |    |       |
| 60          |    |    |    |    |    | 3  | 3           | 60       |    |    |    |    |    |    |       |
| 55          |    |    |    |    |    | 4  | 4           | 55       |    |    |    |    |    |    |       |
| 50          |    |    |    |    |    |    |             | 50       |    |    |    |    |    |    |       |
| 45          |    |    |    |    |    |    |             | 45       |    |    |    |    |    |    |       |
| 40          |    |    |    |    |    | 1  | 2           | 40       |    |    |    |    |    |    |       |
| 35          |    |    |    |    |    | 1  | 1           | 35       |    |    |    |    |    |    |       |
| 30          |    |    |    |    |    | 2  | 2           | 30       |    |    |    |    |    |    |       |
| Total       |    |    |    | 2  | 7  | 38 | 42          | Total    |    |    | 1  | 4  |    | 87 | 42    |

SCHOOLS LIST

# READING

343

| SCALE D     |    |    |    |    |    |    |       | SCALE E     |    |    |    |    |    |    |       |
|-------------|----|----|----|----|----|----|-------|-------------|----|----|----|----|----|----|-------|
| POINTS—RATE |    |    |    |    |    |    |       | POINTS—RATE |    |    |    |    |    |    |       |
| Accuracy    | 10 | 12 | 14 | 16 | 18 | 20 | Total | Accuracy    | 10 | 12 | 14 | 16 | 18 | 20 | Total |
| 100%        |    |    | 1  |    |    |    | 1     | 100%        | 1  |    |    | 1  |    |    | 2     |
| 95          |    |    |    |    |    |    | 2     | 95          |    |    |    |    |    |    | 5     |
| 90          |    |    |    | 5  | 1  |    | 6     | 90          | 1  | 1  |    | 2  |    |    | 5     |
| 85          |    | 1  |    | 1  | 1  |    | 2     | 85          |    |    | 3  |    |    | 1  | 6     |
| 80          |    |    |    | 6  | 4  |    | 10    | 80          |    | 1  |    |    |    |    | 5     |
| 75          |    |    |    |    | 1  | 1  | 3     | 75          |    |    | 2  |    |    |    | 7     |
| 70          |    |    | 1  |    | 5  |    | 6     | 70          |    |    |    |    | 2  |    | 1     |
| 65          |    | 1  |    |    | 2  |    | 3     | 65          |    |    |    | 1  | 4  |    | 5     |
| 60          |    |    | 1  | 2  | 2  |    | 5     | 60          |    |    |    | 1  | 1  | 1  | 3     |
| 55          |    |    |    | 1  | 3  |    | 4     | 55          |    |    |    |    | 1  |    | 2     |
| 50          |    |    |    |    |    | 2  | 2     | 50          |    |    | 1  | 1  | 1  |    | 3     |
| 45          |    |    |    |    |    |    |       | 45          |    |    |    |    |    |    | 2     |
| 40          |    |    |    |    |    |    |       | 40          |    |    |    |    | 2  |    | 1     |
| 35          |    |    |    |    |    |    |       | 35          |    |    |    |    |    |    |       |
| Total       |    | 2  | 3  | 15 | 18 | 3  | 41    | Total       | 2  | 2  | 8  | 12 | 15 | 3  | 42    |

<sup>1</sup>Based on 42 eighth grade scores.

This table is to be read as follows: Out of 42 eighth grade children, 1 child attempted 18 points with an accuracy of 85 per cent.; 3 children attempted 20 points, 1 attempted 18 points, and 1 attempted 16 points with an accuracy of 80 per cent.; and so on; 33 out of 42 children made some attempt to fill in the blanks in every sentence of the test. In accuracy of work the scores range from 30 per cent. to 85 per cent. Note that in Scale D but 3 children out of 41 had time to complete the 20 questions and the accuracies range from 50 to 100 per cent. On the basis of the median score, the accuracy of work for the tests when given on a two minute basis was approximately 5 per cent. higher.

Put in other words, the conventional Trabue scores eliminate very large differences in degrees of skill, and differences in the efficiency with which the skills are used. They reveal only the utmost which a child is capable of achieving, without regard to the effort by which it is achieved. Under such conditions it is not surprising that the results correlate highly with the results from the Binet-Simon Tests and other tests of general intelligence.<sup>1</sup> But to a corresponding degree they are not measures of the effects of classroom training.

If the Kansas Reading Tests were given under conditions similar to those required by Trabue, very different scores would result. For each of the other tests used an equivalent statement can be made. It is important, therefore, that the reader recognize the difference in the conditions and make no comparisons between the results of the Trabue Scales and the results of other tests without keeping this fact in mind.

It is contended by many persons that both the Kansas Silent Reading Tests and the Trabue Scales should not be considered either measures of reading ability or of ability in language work, but measures of general intelligence. It should be evident from the discussions above that neither of these tests measures directly any single product of classroom teaching, and both call for the exercise of much initiative, judgment, and reasoning ability in addition to the ability to read

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<sup>1</sup>See Teachers College, Columbia University, Contributions to Education, No. 77, p. 77.

and understand the material of the tests. The reader should note at this point that if the tests are considered as measures of reading ability, they confirm the previous results in showing that the Gary children do very nearly, if not quite, as well in reading as the children in conventional schools. If the tests are considered as measures of general intelligence and reasoning ability (without attempting to define what those terms may mean), then they show that the Gary children are normal in general capacity and intelligence.

#### RELATIONS BETWEEN TESTS

Perhaps the most convincing proof of the fact that each of the various reading tests used at Gary measures a particular phase of reading ability is found in the relation between the individual scores in various tests. The coefficients of correspondence were computed from the scores of 33 eighth grade children, all who were measured in all of the reading tests (Table LXXXVII, pages 346 and 347). Teachers' marks refer to the marks (in per cent.) assigned by the teachers on the estimate card shown in Figure 53, page 305. Time in oral reading is the number of seconds taken to read a paragraph of Gray's Reading Scale (based on the average for paragraphs four, five, and six). Points in oral reading represent the conventional score in oral reading. Kansas scores, rate scores, and accuracy scores have the meanings previously indicated, but were determined by averaging the two out of three variability ratios that

TABLE LXXXVII  
COEFFICIENTS OF CORRESPONDENCE BETWEEN READING TESTS<sup>1</sup>

| TEST                                                 | MEDIAN | MEDIAN DEVIATION | TOTAL RANGE |
|------------------------------------------------------|--------|------------------|-------------|
| Teachers' per cent. estimate of ability in Reading . | 85     | 6                | 74 - 95     |
| Average time to read paragraphs 4, 5, and 6. ....    | 19     | 3                | 14 - 42     |
| Oral Reading Points. ....                            | 39     | 11               | 22 - 61     |
| Kansas Silent Reading—Score. ....                    | 19.1   | 4.5              | 6.1-55.6    |
| “ “ Rate. ....                                       | 25.8   | 5.5              | 8.1-61.5    |
| “ “ Accuracy. ....                                   | 79.8   | 12.8             | 80 -100     |
| Trabue Score. ....                                   | 18     | 2                | 9 -19       |
| “ Rate. ....                                         | 16     | 1                | 11 -20      |
| “ Accuracy. ....                                     | 74     | 6                | 55 -93      |
| Rate of Silent Reading. ....                         | 196    | 40               | 62 -408     |
| Reproduction—Rate. ....                              | 21     | 3.5              | 11 -31      |
| “ Total Ideas. ....                                  | 6      | 1                | 3 -13       |
| “ Percentage Points. ....                            | 62     | 13               | 33 -100     |

# READING

347

COEFFICIENT OF CORRESPONDENCE

| TESTS |                             | 1*  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 |
|-------|-----------------------------|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1     | Teachers' Marks .....       | —   | 48 | 61 | 61 | 51 | 55 | 55 | 58 | 48 | 39 | 51 | 39 | 51 | 61 |
| 2     | Time Oral Reading .....     | 48  | —  | 64 | 48 | 45 | 42 | 58 | 51 | 30 | 61 | 51 | 45 | 55 | 73 |
| 3     | Points Oral Reading .....   | 61. | 64 | —  | 67 | 67 | 42 | 73 | 45 | 33 | 58 | 48 | 27 | 48 | 85 |
| 4     | Kansas Score .....          | 61  | 64 | 67 | —  | 73 | 45 | 70 | 48 | 36 | 64 | 55 | 39 | 58 | 73 |
| 5     | Kansas Rate .....           | 51  | 45 | 67 | 73 | —  | 45 | 61 | 61 | 30 | 58 | 61 | 48 | 45 | 76 |
| 6     | " Accuracy .....            | 55  | 42 | 42 | 45 | 45 | —  | 42 | 45 | 39 | 24 | 42 | 36 | 51 | 45 |
| 7     | Trabue Score .....          | 55  | 58 | 73 | 70 | 61 | 42 | —  | 61 | 36 | 48 | 51 | 51 | 51 | 76 |
| 8     | " Rate .....                | 58  | 51 | 45 | 48 | 61 | 45 | 61 | 27 | 27 | 48 | 39 | 64 | 55 | 67 |
| 9     | " Accuracy .....            | 48  | 30 | 33 | 36 | 30 | 39 | 36 | 27 | —  | 27 | 42 | 30 | 39 | 42 |
| 10    | Rate, Silent Reading .....  | 39  | 61 | 58 | 64 | 58 | 24 | 48 | 48 | 27 | —  | 39 | 24 | 42 | 61 |
| 11    | Ideas Reproduced .....      | 51  | 51 | 48 | 55 | 61 | 42 | 51 | 39 | 42 | 39 | —  | 42 | 48 | 70 |
| 12    | Accuracy of Reproduction .. | 39  | 45 | 27 | 39 | 48 | 36 | 51 | 64 | 30 | 24 | 42 | —  | 45 | 55 |
| 13    | Rate of Reproduction .....  | 51  | 55 | 48 | 58 | 45 | 51 | 51 | 55 | 39 | 42 | 48 | 45 | —  | 61 |
| 14    | Average Position .....      | 61  | 73 | 85 | 73 | 76 | 45 | 76 | 67 | 42 | 61 | 70 | 55 | 61 | —  |

\*Based on record of 33 eighth grade pupils present for all tests.

The numbers at the top of each column of coefficients indicate the same test as in the vertical column at the left of the table.

This table is to be read as follows: If the relative position of the 33 eighth grade children as determined by teacher's work, upon whose scores this table is based, are compared with their relative positions in average time required to read paragraphs 4, 5, and 6 of Gray's Scale, it is found that 48 per cent. of the children maintain the same relative position within one unit of variability. For a complete discussion of the table see text.

were nearest alike. For instance, if a child's score was  $+1.6$  in one test,  $-2.7$  in a second, and  $+1.8$  in a third, his average would be taken as  $+1.7$ , the low score in the second test being rejected as a chance variation. This procedure was adopted after comparing its effects with results obtained from averaging the actual scores. The ratios were deemed a better basis from which to work because of the differences in the difficulty of the tests. In the case of the Trabue Tests, however, the actual scores in Scales B and C were averaged for score and the actual rates and accuracies in tests with Scales D and E for rate and accuracy respectively. The rate of silent reading is based upon the average of the two nearest variability ratios out of the three in the reading tests. For the reproduction score, ideas reproduced represent the actual number of ideas reproduced, while accuracy of reproduction expresses the relation between the actual points and the possible points. Rate of reproduction refers to the number of words reproduced per minute. Finally, average position was found by averaging the thirteen variability ratios so far described.

The significance of this last measure may need comment. If a child stands very high in all tests he has a high average position. If he does well in some tests and poorly in others, his average position is lower. It is probable that a relatively constant position in all tests is an indication of his natural capacity, so that average position may be regarded as a measure expressing the general capacity of the individual so far as the capac-

ity is revealed by the reading test (Figure 57, page 350).

For most of the reading tests the degrees of correspondence between any two tests are approximately constant. The distribution of coefficients is as follows:

TABLE LXXXVIII

DISTRIBUTION OF COEFFICIENTS OF CORRESPONDENCE OF FOURTEEN  
DIFFERENT TYPES OF SCORES FROM READING TESTS

| RANGE OF COEFFICIENT | 20-29 | 30 | 40 | 50 | 60 | 70 | 80 | TOTAL |
|----------------------|-------|----|----|----|----|----|----|-------|
| Frequency.....       | 5     | 14 | 27 | 20 | 16 | 8  | 1  | 91    |

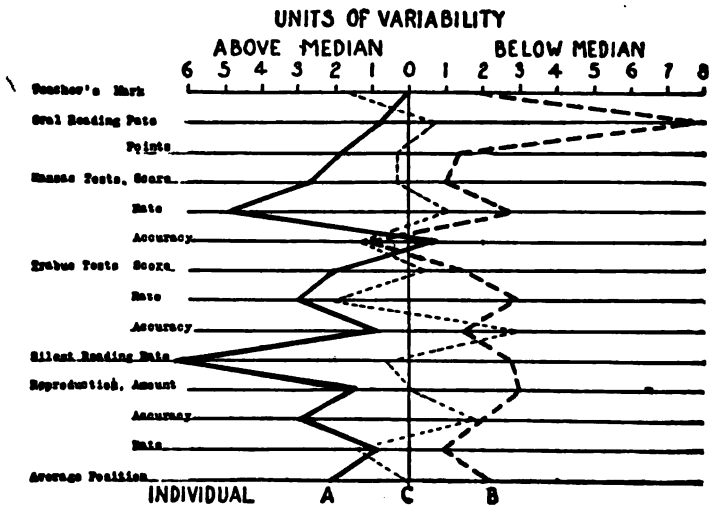
The median coefficient is 50. That is, about half the children will maintain the same relative position in any two sets of scores from reading tests. A coefficient of from 40 to 60 means, therefore, only the degree of correspondence which is to be expected from the fact that all scores are, in general, predetermined by the major factors of heredity, maturity, and training. Where, however, the coefficient of correspondence falls to 30 or 20 per cent. it signifies that one or both of the tests measure peculiar or specific abilities.<sup>1</sup> When the coefficient rises to 60, 70, or 80 per cent. it signifies that scores in the last two tests are determined more nearly by the same factors. It may be that the factor is similarity in the abilities measured, or it may be that the factor is general intelligence, but whatever causes a high score in one test causes a high score in the other also.

<sup>1</sup>Journal of Applied Psychology, March, 1917, Vol. I, p. 26.



## THE GARY SCHOOLS

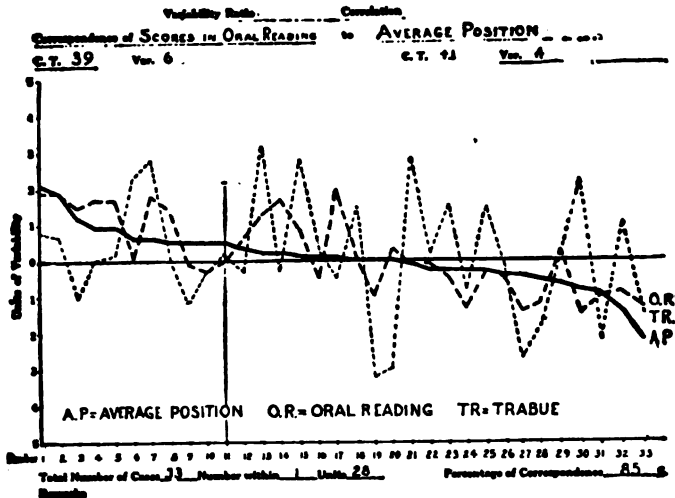
FIGURE 57  
INDIVIDUAL RECORDS IN READING TESTS



The horizontal lines represent 14 different measures of pupil's ability in reading. The vertical line marked "O" represents class median in each phase of reading ability. Distances to the left and right of the class median represent positions above and below in terms of the variability. (Median deviation.) The solid line shows the position in each of the 14 sets of results of the member of the class who had the highest average position. The broken line represents a similar record for the member of the class who had the lowest average position. The dotted line represents the record of the member of the class whose average position was exactly median.

The curve shows that while for individual tests there is a large amount of individual variation, the position of each child shows a tendency to vary about a certain general level of ability. It is probable that this general level is determined more by capacity than by training.

FIGURE 58  
AVERAGE POSITION IN ALL READING TESTS



The scale along the base of the figure represents the individuals of a group of 33 eighth grade children. The solid line shows the relative position of each child in the class as determined by the average of his position in each of 13 sets of scores from Reading Tests. The broken line shows the relative position of the same children as determined by the scores in Gray's Oral Reading Scale. Twenty eight out of 33 children, or 85 per cent., maintain the same position within one unit of variability. The dotted line shows the relative position of the same children based upon accuracy scores in the Trabue Test when given with a time allowance of but two minutes. The percentage of correspondence between the Trabue scores and the oral reading is 33 per cent.

The curves show that the scores in oral reading are probably determined more by capacity than by training, while accuracy scores in the Trabue Tests used as rate tests are measures of a specific ability.

The correspondence between teachers' marks and score for oral reading is high. The correspondence is equally great between teachers' marks and the Kansas Silent Reading Tests, or between teachers' marks and the measure of average position. The correspondence with Trabue is also high. All these, however, are measures of general intelligence. It is extremely probable, therefore, that at Gary teachers' marks reflect the general capacities of the children. On the other hand, rate of silent reading and accuracy of reproduction have very little correspondence with the teachers' marks.

A corollary of the foregoing conclusions is that at Gary scores in Gray's Oral Reading Tests are determined largely by the capacities of the children. The coefficients between the oral reading scores and the measures of general intelligence are all high. The correspondence between scores in oral reading and average position is 85<sup>1</sup> (Figure 58, page 351), a further confirmation of this conclusion. The coefficients also show that time required to read is a large factor in determining the oral reading score, so this in turn must be determined largely by the native capacities of the children.

The coefficients for the different types of scores for the Kansas Silent Reading Tests and for the Trabue Tests are interesting and significant. The conventional scores in these tests show considerable correspondence with measures of general ability but very little with specific abilities. Accuracy, or degree of understanding, is a

<sup>1</sup>Pearson's Coefficient of Correlation,  $\pm .73$ , P. E.  $\pm .05$ .

specific phase of skill in reading, and like all other specific abilities shows a low degree of correspondence with other abilities which are equally specific.

The scores for rate of silent reading show considerable correspondence with the time scores, and with scores for average position, but with all accuracy scores the correspondence is low. Apparently at Gary the rapid readers are not those who read understandingly. It is probable that the rate of reading scores and all the reproduction scores are measures of general abilities, but here again the general correspondence is lower for accuracy of reproduction than for the other abilities.

It should be remembered that these results are based upon very few data and have significance only for Gary. Even for Gary the chief point to the foregoing discussion is that the scores of children in the various tests vary in every conceivable fashion. That is, the relation between abilities or the dependence of one ability upon another varies from child to child. Each test, so far as it measures a specific ability, will yield scores which are significant for that test alone. Therefore, no general comparisons have been made. Only certain phases of reading work have been measured and conclusions drawn are to be interpreted as applying to these particular phases alone.

#### CONCLUSION

The foregoing discussion must have rendered evident the truth of the statement previously made that the

measurements of reading ability at Gary are much less satisfactory than for other subjects. But at least the conventional reading tests have been given carefully, and as much is known about the reading abilities of the Gary children as such tests reveal.

## VIII. FACTORS AFFECTING PERFORMANCE

**M**EASUREMENT of classroom products is ordinarily accomplished by giving standard tests under controlled conditions. The testing activity results in a series of figures (scores) describing either quantitatively or qualitatively the way the children behaved under the test conditions. The question immediately arises: What relations do the scores made by the children in standard tests bear to their real abilities?

A little reflection will show that the results of tests are affected by many factors. For instance, nervousness may lower a child's score for accuracy of work in addition from 100 to 0 per cent., while recent study or practice on a particular test may lead to scores far above the normal level. Hence, the score of a child in a test is a reliable measure of just one thing, what he did in that test.

### HEREDITY

The basic factor in the performance of each individual is his heredity, or capacity.<sup>1</sup> That children differ in capacity is the common experience of all, and these

<sup>1</sup>The three technical terms used in this discussion—performance, ability, and capacity—may be defined as follows:

Performance is the specific achievement (actual score) made in a particular test. Ability is the general power to perform. It is best

differences are observable from birth. So far as the Gary results are concerned, the effects of heredity are either negligible or unknown. In any large unselected group of children the percentages of individuals of exceptional ability, of average ability, and of small ability are probably constant. If, as seems probable, unusually large numbers of the Gary children are born of foreign parents,<sup>1</sup> they might form a selected group as to capacity, provided there were marked racial differences in capacity from country to country. However, the facts in regard to all such hypotheses are wanting. It is known that the children in the Gary schools come from a wide variety of racial stocks. Therefore, as a group, the Gary children probably do not differ greatly in their basic capacities from the average of children in other cities.

For example, the Gary eighth grade children copy figures at the rate of 111 figures per minute as compared with the score of 108 figures per minute for children in other cities (Table LXXXIX, page 358, Figure 59, page 359). The activity involved here is almost entirely the motor activity in writing figures, and no direct training of this character is given in the schools. The differences between the Gary and the country wide results in this

inferred from the median performance in a series of trials of the tests since the amount of variation shown by the series as a whole furnishes a measure of the reliability of the inference. Capacity is potential, or undeveloped ability, the possibilities of development inherent in a child's original nature. For an extended discussion of these definitions see Bulletin No. 4, Courtis Standard Research Tests.

<sup>1</sup> See The Gary Public Schools: A General Account.

test are not significant and are, if anything, in favor of the Gary children. In the Kansas Silent Reading Test and in the Trabue Test, which are considered by many as measures of general intelligence, the differences between the Gary results and those from other cities are small.<sup>1</sup> In view of all the facts that are available, the author considers it probable that the Gary children represent a normal group as far as inheritance of average mental capacity is concerned.<sup>2</sup>

#### MATURITY

The second important general factor affecting performance is maturity. By maturity is meant that increase in ability from grade to grade caused not by additional purposive school training, but by the greater development, increased vigor, and riper experience due to added age.

For instance, in the first trial of the test of copying figures, 53 figures per minute were written by the third grade children. This proves that as a result of the training in the early grades the ability to write figures is well developed by the third grade. The grade scores

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<sup>1</sup>See Chapter VII, page 290.

<sup>2</sup>In Gary there is a formal organization of health, dental, and psychological clinics, and several classes are composed wholly of children whose mental condition is such that they are not the equal of normal children. The scores of such classes are not included in the tabulations of the preceding chapters. The Gary results would be lower if the children from the special classes had been distributed through the grades on the basis of their ages.



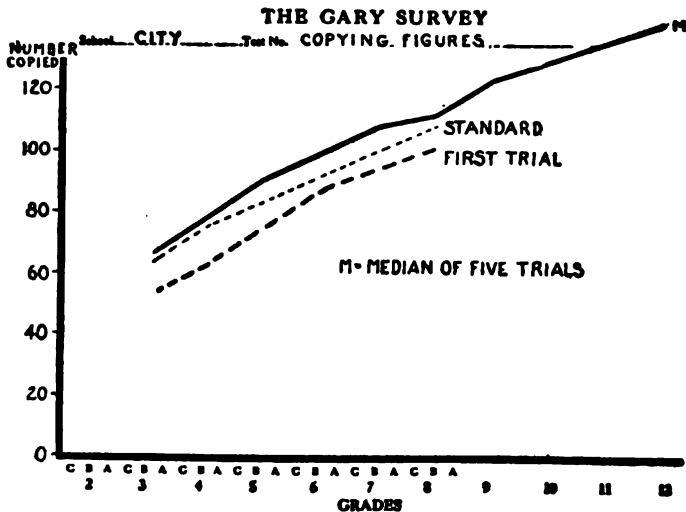
TABLE LXXXIX  
RATE OF MOTOR ACTIVITY IN COPYING FIGURES

| GRADE                                | 3  | 4  | 5  | 6  | 7   | 8   | 9   | 10  | 11  | 12  |
|--------------------------------------|----|----|----|----|-----|-----|-----|-----|-----|-----|
| Gary, 1st Trial <sup>1</sup> .....   | 53 | 63 | 75 | 87 | 94  | 101 | 109 | 118 | 123 | 120 |
| Scores, Median of Five Trials.....   | 66 | 78 | 91 | 99 | 108 | 111 | 123 | 128 | 134 | 143 |
| Standard Based on 66,837 Scores..... | 63 | 75 | 84 | 92 | 100 | 108 | —   | —   | —   | —   |

<sup>1</sup>Superintendent Wirt has called attention to the fact that on the first trial the Gary scores were quite uniformly one year lower than the standard score. The author does not consider this significant, as, on the second trial, the scores rose at once to the normal level. In his judgment the effect was probably due to the fact that this was the first trial of the first test given at Gary.

This table is to be read as follows: The third grade at Gary copied 53 figures per minute on the first trial of the tests. Their median performance in five trials of the same test was 66 figures per minute. The standard single trial performance based upon thousands of scores from all parts of the country is 63 figures per minute. The Gary children are probably a normal group so far as the abilities measured by the test are concerned.

FIGURE 59  
DEVELOPMENT IN COPYING FIGURES



The scale along the base of the figure represents grades. The scale along the vertical axis at the left represents the number of figures copied per minute. The heavy curve in the figure is based upon the median scores of the various grades. Taking into consideration the records made by each individual in the five separate trials of the test, the median scores based upon the results of the first trial are shown by the broken line. The standard scores based upon records of about 60,000 children throughout the country are shown by the light dotted line.

Differences between the standard and the Gary scores are not significant, but tend to show that on the first trial the Gary children reacted to the test situation more slowly than the children of the average school, but that on the basis of the median of five trials the scores are higher than those of the average school. They also show that development in this test at Gary follows very closely the conventional rates, so that the Gary children in respect to the abilities measured by this test are probably a normal, that is, an unselected, group.

change from 53 figures per minute in the third grade to 120 figures per minute in the twelfth grade. This change, however, is not due to increased knowledge or to direct training, but solely to that increase in ability which comes from increased maturity.

It may be objected that the ability to copy figures is a direct product of school training. This is, of course, true in a general sense. If the children had received no training whatever in copying figures, their scores would all have been zero, or nearly so. However, no specific training in copying figures is given as such. Whatever the activity to be tested, some form of motor response will be an essential part of the total response and the actual performance of the child will be influenced by his whole past life. This is not what we ordinarily mean by school training. The increases discussed above represent, of course, the increase due to maturity, pure and simple, plus the transfer due to the general training of daily school and home life. This does not mean that a test in copying figures can be used to measure maturity, merely that maturity is a factor contributing to the change in score.

Both at Gary and in the results based upon thousands of children in many school systems, the third grade score is 58 per cent. of the eighth grade score, the fourth 69 per cent., and so on (Table XC, page 361). The correspondence between the rate of increase of score at Gary and in school children generally is almost perfect. That is, for both the Gary children and children in general the

TABLE XC

## DEVELOPMENT OF ABILITY IN COPYING FIGURES

| GRADE                                              | 3  | 4  | 5  | 6  | 7  | 8   |
|----------------------------------------------------|----|----|----|----|----|-----|
| Gary.....                                          | 59 | 70 | 82 | 89 | 97 | 100 |
| Gary based on 115 as the eighth grade scores. .... | 57 | 68 | 79 | 86 | 94 | 100 |
| Standard based on 66,837 individual scores. ....   | 58 | 69 | 78 | 85 | 92 | 100 |

The scores of Table LXXXIX are here expressed as percentages of the eighth grade score.

The table is to be read as follows: The Gary third grade in copying figures is 59 per cent. of the eighth grade score; the fourth grade score is 70 per cent. of the eighth grade score, and so on. In Table LXXXIX, page 358, the eighth grade score is lower than it should be compared with the seventh and ninth grade scores. The average of the seventh and ninth grade scores is 115 figures per minute.

The second line in the table above is to be read as follows: The Gary third grade score in copying figures is 57 per cent. of 115, the fourth grade 68 per cent., and so on. On this basis, the rate of development at Gary is almost precisely that determined from the scores of 66,837 children in schools in many states.

rate of increase in this test is determined by the rate of increase of maturity because it is not determined by express school training directed to that end.

If the results from the different tests at Gary are studied from this point of view it will be found that the various scores for rate of work may be divided into three groups or classes (Table XCI, page 363). Class A includes three tests, copying figures, oral reading, and multiplication tables, in which the motor and mental activities involved have been quite fully habituated earlier than the lowest grades in which the testing work begins. Most children

are able to do the thinking called for in these tests much more readily than they can write or speak, so that their rate of work is determined almost wholly by the rate of motor activity. At Gary all three sets of scores show the same rate of development. The inference to be drawn from these data is that the instruction in oral reading and in the multiplication tables has produced no greater effects upon the rate of development of the abilities of the Gary children in these tests than the generalized training has upon the ability to copy figures. Ability develops at a rate which is the same for all, and which is fully accounted for by the increase in maturity or general training.

In class B are included the rate scores for five other tests, the cancellation test, the rate of writing in the free choice test, in the reproduction test, in the composition test, the rate of adding in Series B, and the rate of answering questions in the Kansas Silent Reading Test. In all these activities the motor element is dependent upon, and controlled by, the mental. A child cannot cancel triangles faster than he can discriminate between the different forms; he cannot write the answers to addition examples faster than he can think the sum of the successive addends; he cannot write the words in the composition test until he has determined what words are to be written. The scores of the tests in class B, therefore, represent activities of quite a different type from those in class A.

The children at Gary could not have received any di-

TABLE XCI  
COMPARATIVE DEVELOPMENT OF RATE SCORES IN VARIOUS TESTS

Generalized City Wide Scores Expressed Both in Specific Units and in Terms of Relative Development (Percentage of Eighth Grade Score). Tests Classified According to the Nature of Development.

CLASS A

Motor and mental activities fully habituated. Rate of mental activity much greater than possible motor activity, so that the rate of the mental activity is determined by the rate of the motor.

| Test                                     | GRADES |     |     |     |      |      |      |      |      |      |      |
|------------------------------------------|--------|-----|-----|-----|------|------|------|------|------|------|------|
|                                          | 2      | 3   | 4   | 5   | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| ACTUAL SCORES                            |        |     |     |     |      |      |      |      |      |      |      |
| Copying Figures.....                     |        | 66  | 78  | 91  | 99   | 108  | 111  | 123  | 128  | 134  | 143  |
| Oral Reading <sup>1</sup> .....          | 72     | 118 | 143 | 162 | 187  | 195  | 200  | 18.6 | 20.3 | 21.5 | 22.7 |
| Multiplication Tables <sup>2</sup> ..... |        | 4.7 | 7.2 | 9.7 | 12.2 | 14.2 | 16.9 |      |      |      |      |
| RELATIVE DEVELOPMENT                     |        |     |     |     |      |      |      |      |      |      |      |
| Copying Figures.....                     |        | 59  | 70  | 82  | 89   | 97   | 100  | 111  | 115  | 121  | 128  |
| Oral Reading.....                        | 36     | 59  | 72  | 81  | 84   | 86   | 100  |      |      |      |      |
| Multiplication Tables.....               |        | 62  | 74  | 82  | 89   | 96   | 100  |      |      |      |      |
| Average                                  |        | 60  | 72  | 82  | 91   | 97   | 100  |      |      |      |      |

<sup>1</sup>Based on average rate for paragraphs 1 and 4, page 286.

<sup>2</sup>See page 166.

<sup>3</sup>Twelfth grade score used as base, to show that the development to this point proceeds at the same rate as for the other abilities to the eighth grade.

## THE GARY SCHOOLS

TABLE XCI (Continued)

## CLASS B

Activities in which the motor is dependent upon and controlled by the mental, but in which the mental ability at Gary is mainly the result of general, not specific, training.

| TEST                                | GRADES |      |      |      |      |      |      |      |      |      |      |
|-------------------------------------|--------|------|------|------|------|------|------|------|------|------|------|
|                                     | 2      | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| <b>ACTUAL SCORES</b>                |        |      |      |      |      |      |      |      |      |      |      |
| Canceling Triangles, 1st trial..... |        | 9.7  | 10.8 | 14.1 | 16.2 | 19.0 | 21.6 | 21.6 | 22.9 | 22.0 | 24.7 |
| Writing, Free Choice Test.....      |        | 20   | 46   | 60   | 72   | 82   | 92   | 102  | 108  | 115  | 121  |
| Writing, Reproduction Test.....     |        | 30   | 40   | 50   | 60   | 70   | 78   | 83   | 86   | 89   | 92   |
| Writing, Composition Test.....      |        |      | 27   | 34   | 41   | 48   | 54   | 59   | 61   | 64   | 64   |
| Adding, Series B, Test I.....       |        |      | 4.3  | 5.3  | 6.3  | 7.3  | 8.3  | 8.8  | 9.3  | 9.8  | 10.2 |
| Kansas Silent Reading Test*.....    |        | 12.3 | 14.9 | 18.1 | 20.5 | 23.8 | 23.9 | 34.0 | 33.5 | 33.7 | 30.8 |
| Grip, Boys and Girls Combined**..   |        | 13.6 | 16.6 | 17.7 | 20.1 | 23.1 | 26.6 | 30.2 | 34.0 | 37.1 | 38.5 |
| <b>RELATIVE DEVELOPMENT</b>         |        |      |      |      |      |      |      |      |      |      |      |
| Canceling Triangles, 1st Trial..... |        | 45   | 50   | 65   | 75   | 88   | 100  | 100  | 105  | 102  | 114  |
| Writing, Free Choice Test.....      |        | 22   | 50   | 65   | 78   | 89   | 100  | 111  | 117  | 125  | 131  |
| Writing, Reproduction Test.....     |        | 36   | 51   | 64   | 77   | 90   | 100  | 106  | 110  | 114  | 118  |
| Writing, Composition Test.....      |        |      | 50   | 63   | 76   | 89   | 100  | 109  | 113  | 119  | 119  |
| Adding, Series B, Test I.....       |        |      | 52   | 64   | 76   | 88   | 100  | 106  | 112  | 118  | 123  |
| Kansas Silent Reading Test.....     |        | 51   | 62   | 63   | 76   | 86   | 100  | 100  | 100  | 144  | 141  |
| Grip, Boys and Girls Combined... .. |        |      | 62   | 66   | 76   | 87   | 100  | 113  | 128  | 139  | 145  |
| Average                             |        | 39   | 52   | 64   | 76   | 88   | 100  |      |      |      |      |

\*Seventh grade score used as base to show that the development to this point proceeds at the same rate as for the other abilities to the eighth grade.

\*\*Smedley, F., 46th Annual Report, Board of Education, Chicago.

TABLE XCI (Continued)

## CLASS C

Miscellaneous Scores in Which Rate of Work Is Largely Determined by Training and in Which Variations in Rate of Growth Are Shown.

| TEST                            | GRADES |     |     |     |      |      |      |      |      |      |      |
|---------------------------------|--------|-----|-----|-----|------|------|------|------|------|------|------|
|                                 | 2      | 3   | 4   | 5   | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| ACTUAL SCORES                   |        |     |     |     |      |      |      |      |      |      |      |
| Silent Reading.....             | 54     | 109 | 140 | 166 | 185  | 198  | 204  | 236  | 249  | 262  | 270  |
| Division, Series B, Test 4..... |        |     | 2.4 | 3.2 | 4.1  | 5.3  | 6.7  | 7.4  | 8.2  | 8.7  | 9.2  |
| Simple Fractions.....           |        | .6  | 1.9 | 3.2 | 4.8  | 5.5  | 6.4  | 7.3  | 8.1  | 8.3  | 8.5  |
| Complex Fractions.....          |        | 6.5 | 1.2 | 5.4 | 7.6  | 8.4  | 8.5  | 8.5  | 8.5  | 8.5  | 8.5  |
| Trabue.....                     |        |     | 8.5 | 9.9 | 11.2 | 12.5 | 13.6 | 14.3 | 14.9 | 15.3 | 16.0 |
| RELATIVE DEVELOPMENT            |        |     |     |     |      |      |      |      |      |      |      |
| Silent Reading**.....           | 26     | 53  | 69  | 81  | 91   | 97   | 100  | 116  | 122  | 128  | 132  |
| Division.....                   |        |     | 36  | 48  | 61   | 79   | 100  | 110  | 122  | 130  | 137  |
| Simple Fractions*.....          | 23     | 40  | 59  | 68  | 79   | 90   | 100  | 102  | 105  | 100  | 100  |
| Complex Fractions.....          |        |     | 14  | 64  | 89   | 99   | 100  | 100  | 100  | 100  | 100  |
| Trabue.....                     |        | 48  | 62  | 73  | 82   | 92   | 100  | 105  | 110  | 114  | 118  |

\*Tenth grade score used as base to show that the development to this point proceeds at the same rate as for the other abilities to the eighth grade.

\*\* Compare 5th to 8th grade percentages with the average values for Class A.

This table is to be read as follows: The actual grade scores for rate of copying figures were: third grade, 66 figures per minute; fourth grade, 76 figures per minute; and so on. Expressed as percentages of the eighth grade score, these scores become 50 per cent., 70 per cent. and so on.

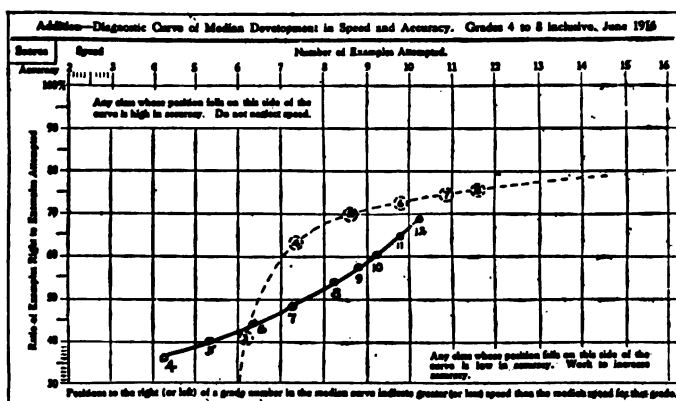
The table shows that for classes A and B there is a rate of development uniform for all the rate scores in the group. In class B the rate agrees closely with the rate of development of grip in Chicago children.<sup>3</sup>



rect training for the test in canceling triangles, as it was comparatively a new test, not in general use, and not related to conventional school work. Yet the rate of relative development in the cancellation test is almost the same as the rate of development in addition and in the various other tests of the group. For all tests, the average third grade score is 39 per cent. of the eighth grade score, the fourth grade 52 per cent., the fifth grade 64 per cent., and so on. Moreover, these percentages correspond (except in the lowest grades) with the rate of development of the strength of grip of boys and girls in the elementary grades (derived from Smedley's measurement of 6,000 children in the Chicago schools). Under the circumstances, it is plainly to be seen that rate scores in the tests of class B are determined by maturity and general training rather than by the direct effects of school work.

In this connection the reader is referred to Figure 25 which is reproduced here as Figure 60. The difference between the two curves in the graph represents the difference between the Gary product and the conventional product, or the difference between incidental development and development under formal training. In other words, there is no evidence that the Gary children develop in ability any more rapidly because of the training received in school than they would develop if they left school at the fourth grade and were subject merely to the general training of life. The increase in score in addition would seem to be due almost wholly to

FIGURE 60  
DEVELOPMENT IN SPEED AND ACCURACY—ADDITION



Comparison of development in addition at Gary with median development in rate and accuracy in addition based upon a tabulation of the results from tests of thousands of children in cities of many different types.

The scale along the top of the figure represents rate, or the number of examples attempted (speed). The scale along the left hand side of the figure represents the ratio of examples right to examples attempted, or the accuracy of work expressed in per cent. Each point of the diagram, therefore, represents two scores, rate and accuracy. The position of the circle marked "4" on the general curve (broken line) represents a rate of 7.4 examples attempted and 64 per cent. accuracy.

The curve for the Gary results is shown by the heavy line. The circles indicate the position of the different grade scores. The twelfth grade score in rate falls between the sixth and seventh grade score on the general curve, and in accuracy is slightly below the fifth grade level. The eighth grade Gary results are not quite equal to the general fifth grade scores in rate, and very much lower than the fourth grade in accuracy.

The position of the general curve below the fourth grade is not very

FIGURE 60—*Continued*

reliable, but the differences between the general character of the Gary curve and that of the general curve is marked. The general curve indicates that the development of skill in addition is, in the conventional school, nearly completed by the end of grade five, while the Gary curve shows that there is a very small, but regular, increase in rate and accuracy from grade to grade up to the end of the high school years. In high school years there is no direct training for the development of skill in addition, so the progress from grade to grade must represent either incidental training or the effect of the elimination of the less able by non-promotion. Therefore, the Gary curve as a whole would seem to indicate that growth in skill in addition in all grades is due mainly to the same causes, and very little to direct training.

maturity and not to direct training. If this resulted in adequate rate and accuracy of work, no greater commendation of the Gary system could be given. But the levels of ability developed are not adequate, and, in view of the attention given to formal drill, the figures show merely the extent to which the classroom training fails to function.<sup>1</sup>

Class C in Table XCI, page 363, includes the scores of a number of other tests which have very different rates of development. They are given to prove that the figures

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<sup>1</sup>Perhaps it is well to point out that if any part of the low scores at Gary were due to the care with which the tests were given and scored, the effect of making the Gary scores comparable with those from other cities would be merely to shift the position of the Gary curve in the figure, not to change its character. In the opinion of the author, Figure 60 and the tables of this chapter are satisfactory evidence that the Gary scores reflect a real condition, and not merely the effect of some unusual element in the testing conditions.

previously quoted are not the results of chance. A child cannot learn long division, for example, or how to multiply one fraction by another by any ordinary form of incidental training, and the rate of development for such activities is very different from those given in the other two parts of the table. For instance, in accuracy of work in the four operations with fractions, the fourth grade accuracy is 58 per cent. of the eighth grade development, but the increase in the next two grades is very slight, and in the following two grades the increase is very rapid (Table XCII, pages 370-1). In other words, in those grades in which there was practically no training, the accuracy scores are nearly stationary, but as soon as training begins they develop rapidly.<sup>1</sup>

From the foregoing discussion it should be evident that in making comparisons from city to city the maturity of the children must be taken into consideration. If the children in one city are much older for the grade than those of another city, the rate scores made in any test in the first city would be almost invariably higher than those in the second city, even though the two were really equal in educational efficiency. As has already been mentioned, in Gary tabulations of the ages of children show that in the Froebel school in some grades the children are, on the average, a year older than the children of the corresponding grades in the other schools

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<sup>1</sup>For the benefit of those who would like to check the conclusions above by reference to data from other surveys, such data, arranged in form similar to the Gary results, will be found in Appendix A, page 397.

TABLE XCII  
COMPARATIVE DEVELOPMENT IN QUALITY OR ACCURACY IN VARIOUS TESTS

| Tests                      | ACTUAL SCORES IN GRADES |    |    |    |    |    |    |    |    |    |
|----------------------------|-------------------------|----|----|----|----|----|----|----|----|----|
|                            | 3                       | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |
| Handwriting.....           | 31                      | 32 | 34 | 37 | 41 | 44 | 45 | 46 | 47 | 48 |
| Spelling, Dictation.....   |                         | 42 | 49 | 49 | 64 | 69 |    |    |    |    |
| Spelling, Composition*     |                         | 29 | 32 | 36 | 73 | 83 | 87 | 91 | 98 | 94 |
| Composition.....           |                         | 36 | 40 | 44 | 49 | 44 | 50 | 56 | 61 | 64 |
| Addition.....              |                         | 41 | 48 | 55 | 64 | 55 | 57 | 60 | 64 | 68 |
| Subtraction.....           |                         | 37 | 45 | 52 | 61 | 72 | 75 | 75 | 78 | 82 |
| Multiplication.....        |                         | 24 | 34 | 44 | 60 | 67 | 68 | 68 | 68 | 70 |
| Division.....              |                         | 85 | 89 | 91 | 93 | 74 | 80 | 81 | 84 | 86 |
| Multiplication Tables..... | 78                      | 66 | 75 | 80 | 84 | 94 | 95 | 95 | 96 | 96 |
| One Place Multiplier.....  | 51                      | 33 | 39 | 48 | 58 | 55 | 85 | 85 | 86 | 87 |
| Two Place Multiplier.....  | 26                      | 36 | 44 | 51 | 55 | 66 | 67 | 68 | 69 | 72 |
| Simple Fractions.....      | 28                      | 26 | 28 | 30 | 33 | 63 | 74 | 84 | 85 | 85 |
| Complex Fractions.....     |                         | 26 | 28 | 30 | 33 | 45 | 52 | 56 | 56 | 58 |
| Kansas Reading.....        | 23                      | 50 | 59 | 69 | 75 | 83 | 88 | 93 | 98 | 96 |

## RELATIVE DEVELOPMENT

|                                | 70 | 73 | 77 | 84 | 88 | 100 | 102 | 105 | 107 | 109 |
|--------------------------------|----|----|----|----|----|-----|-----|-----|-----|-----|
| Handwriting. . . . .           |    |    |    | 71 | 93 | 100 | 100 | 105 | 112 | 113 |
| Spelling, Dictation. . . . .   |    | 51 | 59 | 71 | 88 | 100 | 105 | 110 | 127 | 145 |
| Spelling, Composition. . . . . |    | 66 | 73 | 82 | 91 | 100 | 114 | 127 | 139 | 145 |
| Composition. . . . .           |    | 65 | 73 | 80 | 89 | 100 | 104 | 109 | 116 | 124 |
| Addition. . . . .              |    | 57 | 67 | 76 | 89 | 100 | 104 | 104 | 108 | 114 |
| Subtraction. . . . .           |    | 55 | 67 | 78 | 91 | 100 | 101 | 101 | 101 | 104 |
| Multiplication. . . . .        |    | 32 | 46 | 59 | 81 | 100 | 108 | 109 | 114 | 116 |
| Division. . . . .              |    | 90 | 95 | 97 | 99 | 100 | 101 | 101 | 102 | 102 |
| Multiplication Tables. . . . . | 83 | 78 | 88 | 94 | 99 | 100 | 100 | 100 | 101 | 102 |
| One Place Multiplier. . . . .  | 60 | 73 | 88 | 94 | 99 | 100 | 100 | 100 | 101 | 102 |
| Two Place Multiplier. . . . .  | 39 | 50 | 59 | 73 | 88 | 100 | 102 | 103 | 104 | 109 |
| Simple Fractions. . . . .      | 44 | 57 | 70 | 81 | 87 | 100 | 117 | 133 | 135 | 135 |
| Complex Fractions. . . . .     |    | 58 | 62 | 67 | 73 | 100 | 116 | 124 | 124 | 124 |
| Kansas Reading. . . . .        | 34 | 60 | 71 | 88 | 90 | 100 | 106 | 112 | 118 | 116 |

\*Values obtained by subtracting from 100 the coefficient for misspellings given in Table XIX, page 93.

This table is to be read as follows: In the free choice handwriting test, the third grade quality was 31 Ayres, the fourth grade, 32 Ayres, and so on. Expressed as percentages of the quality attained by the eighth grade, the figures become: third grade, 70 per cent., fourth grade, 73 per cent., and so on.

TABLE XCII  
COMPARATIVE DEVELOPMENT IN QUALITY OR ACCURACY IN VARIOUS TESTS

| TESTS                      | ACTUAL SCORES IN GRADES |    |    |    |    |    |    |    |    |    |  |  |
|----------------------------|-------------------------|----|----|----|----|----|----|----|----|----|--|--|
|                            | 3                       | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |  |  |
| Handwriting.....           | 31                      | 32 | 34 | 37 | 41 | 44 | 45 | 46 | 47 | 48 |  |  |
| Spelling, Dictation.....   |                         | 42 | 49 | 49 | 64 | 69 |    |    | 93 | 94 |  |  |
| Spelling, Composition..... |                         | 29 | 32 | 36 | 40 | 44 | 50 | 56 | 61 | 64 |  |  |
| Composition.....           |                         | 36 | 40 | 44 | 49 | 55 | 57 | 60 | 64 | 68 |  |  |
| Addition.....              |                         | 41 | 48 | 55 | 64 | 72 | 75 | 75 | 78 | 82 |  |  |
| Subtraction.....           |                         | 37 | 45 | 52 | 61 | 67 | 68 | 68 | 68 | 70 |  |  |
| Multiplication.....        |                         | 24 | 34 | 44 | 60 | 74 | 80 | 81 | 84 | 86 |  |  |
| Division.....              |                         | 85 | 89 | 91 | 93 | 94 | 95 | 95 | 96 | 96 |  |  |
| Multiplication Tables..... | 78                      |    |    |    |    |    |    |    |    |    |  |  |
| One Place Multiplier.....  | 51                      | 66 | 75 | 80 | 84 | 85 | 85 | 85 | 86 | 87 |  |  |
| Two Place Multiplier.....  | 26                      | 33 | 39 | 48 | 58 | 66 | 67 | 68 | 69 | 72 |  |  |
| Simple Fractions.....      | 28                      | 36 | 44 | 51 | 55 | 63 | 74 | 84 | 85 | 86 |  |  |
| Complex Fractions.....     |                         | 28 | 28 | 30 | 33 | 45 | 52 | 56 | 56 | 56 |  |  |
| Kansas Reading.....        | 28                      | 50 | 59 | 69 | 75 | 83 | 88 | 93 | 93 | 96 |  |  |

## TRAINING

The third major factor which influences performance is school training. When the test exercises are similar in every way to the daily work of the classroom, performances in the test may directly reflect school training. The list tests in spelling are almost perfect examples of tests of this type. Had the lists been based upon the words taught by the teacher during the term, and had they been given in the regular course of a day's work without special papers and without special knowledge on the part of the children of the character of the work being done, performance would have been even more largely determined by school training. Finally, if several initial tests of equal difficulty, based on the same words had been given at the beginning of the term, so that each individual's initial ability was known, a comparison of the final with the initial performance would have revealed the effect of school training,<sup>1</sup> or the changes primarily produced by teaching effort.

The educational tests given at Gary did not have for their purpose the direct determination of the effects of teaching effort, but the measurement of all the forces

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<sup>1</sup>This does not mean at all that changes would be the same for each pupil. The actual response an individual makes to training is also determined by heredity, maturity, past training, and present conditions. It does mean that school training would be the major force acting to produce change and that the changes which took place would be a measure of the effects of this force. In case of sickness or other special conditions, of course, the statement would not be true at all.



acting, of which school training is one. For example, if the idea of comparing the efficiency of, say, the Boston and the Gary schools comes to mind, what is meant by such a comparison is the equality or inequality of the final product. The questioner asks, in effect: "Will the Gary children at any grade level be more capable of performing school tasks, and of meeting the demands of child and adult life outside of school, than Boston children of the same age and grade?" He does not ask the narrower and more difficult question: Does the Gary training, hour for hour, produce greater or less effects than the Boston training? He assumes that if the training is more efficient, the resulting product will be correspondingly greater.

In attempting to answer such a question, we assume that differences in the effects of the factors of heredity, maturity, all training except that given by the school, and all other special conditions, are negligible and that difference in school training is the one factor that causes differences in results. The reader will readily see that this means that all the effects of street life, home life, and all other forms of training acting to produce ability are taken as being identical from city to city and from state to state, when a moment's reflection shows that they cannot possibly be identical. Yet no other course is possible at present. Nevertheless, the fact should be kept in mind that the products measured are resultants of all the training factors acting and not the narrower and more specific products—the changes produced by teaching ef-

fort alone. Hence the care taken above to consider the possible effects of each factor that might have operated to produce the low scores at Gary.

#### YEARS SPENT IN GARY

In this connection one special factor needs discussion, the influence that the number of years of training received at Gary has upon the results. Gary is a rapidly growing city, large numbers of children being new to the school each year. An interesting and important question is: "What have the tests to show in regard to the abilities of such children in comparison with the abilities of children who have received part or all of their training in the Gary schools?"

Three types of ability were selected for this study, accuracy of work in the List Spelling Tests, rate and accuracy in the arithmetic test, and rate and accuracy in the Kansas Reading Test. Tabulations were made separately for those groups of children in the seventh and eighth grades who had been in the Gary classes one, two, three, four, five, six, seven, eight, and nine years. Unfortunately, however, records of entrance into, and progress through, the Gary schools were found to be imperfectly kept. Consequently the data in regard to the number of years in Gary are not as reliable as one would like. The results given in the following tables are, however, based upon the official records of the school, and not upon the children's statement as to the length of time spent in Gary; for from ten to twenty per

cent. of the cases no information whatever could be secured.

Tabulations were made in spelling and in the Kansas Reading Test for the seventh grade as representing a larger number of cases than the eighth grade. For spelling similar tabulations were made for the eighth grade. Out of a total of 260 seventh grade children, the number of individuals who have lived in Gary one, two, three, etc., years is fairly constant (up to six years), averaging 30 to each group.

The results admit of no simple interpretation. The children who have been in Gary five or six years (score in spelling, five years, 57.9 per cent.; six years, 52.6 per cent.) do quite or nearly as well as those who have entered during the year 1915-1916 (score 57.9 per cent.) (Tables XCIII, page 377, and XCIV, page 378). On the other hand, children who have been in the Gary schools two or three years, or seven, eight, or nine years, more often have lower scores than those who have just entered, or who have been in attendance for five or six years.

Several explanations are possible, and in the absence of definite information no certain conclusions can be drawn. On the face of the results it would seem that for two or three years following entrance into the Gary schools a period of readjustment to the new conditions follows in which the abilities of the children are low. However, for those children who have spent the major portion of their school lives in the Gary schools the results are equal to the results obtained in the schools from

TABLE XCIII  
NUMBER OF YEARS IN GARY AND ABILITY IN SPELLING, ADDITION, AND READING

| COMPARISON ON BASIS OF EIGHTH GRADE SCORES |                     |            |            |            |            |            |            |            |           |           |              |             |  |
|--------------------------------------------|---------------------|------------|------------|------------|------------|------------|------------|------------|-----------|-----------|--------------|-------------|--|
| Subject                                    | Years Spent in Gary |            |            |            |            |            |            |            |           | Unknown   | Entire Class | Standard    |  |
|                                            | 1                   | 2          | 3          | 4          | 5          | 6          | 7          | 8          | 9         |           |              |             |  |
| Spelling<br>(List Tests)                   | Cases<br>Score      | 12<br>57.9 | 11<br>54.5 | 14<br>56.4 | 17<br>53.5 | 19<br>52.6 | 25<br>49.4 | 28<br>51.8 | 3<br>40.0 | 9<br>41.6 | 143<br>53.1  | 76          |  |
| Addition<br>Rate<br>Accuracy               | Cases<br>Score      | 11<br>7.6  | 11<br>10.0 | 14<br>8.0  | 17<br>9.5  | 14<br>10.0 | 18<br>8.5  | 24<br>7.6  | 6<br>5.0  | 3<br>5.5  | 10<br>7.0    | 128<br>8.2  |  |
|                                            | Score               | 65.0       | 57.5       | 41.6       | 66.6       | 60.0       | 55.0       | 53.3       | 32.5      | 41.6      | 55.5         | 74          |  |
| Reading<br>(Kansas)<br>Rate<br>Right       | Cases<br>Score      | 11<br>24.0 | 9<br>24.0  | 13<br>27.5 | 16<br>24.0 | 16<br>30.0 | 21<br>23.6 | 24<br>21.0 | 9<br>21.0 | 2<br>18.0 | 10<br>20.2   | 131<br>23.7 |  |
|                                            | Score               | 22.2       | 21.7       | 22.5       | 20.5       | 24.0       | 21.7       | 21.0       | 18.0      | 18.0      | 21.3         | 18.8        |  |

| COMPARISON ON BASIS OF SEVENTH GRADE SCORES |                     |            |            |            |            |            |            |            |           |           |              |             |     |
|---------------------------------------------|---------------------|------------|------------|------------|------------|------------|------------|------------|-----------|-----------|--------------|-------------|-----|
| Subject                                     | Years Spent in Gary |            |            |            |            |            |            |            |           | Unknown   | Entire Class | Standard    |     |
|                                             | 1                   | 2          | 3          | 4          | 5          | 6          | 7          | 8          | 9         |           |              |             |     |
| Spelling                                    | Cases<br>Score      | 31<br>70.5 | 26<br>57.3 | 32<br>56.4 | 31<br>59.8 | 34<br>73.1 | 42<br>64.6 | 28<br>53.6 | 8<br>66.2 | 2<br>50.0 | 26<br>55.8   | 260<br>61.9 | 76  |
| Arithmetic<br>Rate<br>Accuracy              | Cases<br>Score      | 38<br>7.7  | 22<br>6.5  | 25<br>7.8  | 28<br>7.3  | 30<br>7.7  | 39<br>7.4  | 22<br>7.0  | 6<br>6.3  | 2<br>8.0  | 21<br>7.0    | 253<br>7.4  | 9.8 |
|                                             | Score               | 50.8       | 45.0       | 42.5       | 43.0       | 35.0       | 51.4       | 40.0       | 55.0      | 25.0      | 52.5         | 43.1        | 72  |
| Reading<br>Rate<br>Right                    | Cases<br>Score      | 30<br>23.6 | 24<br>21.0 | 29<br>23.2 | 31<br>27.4 | 35<br>20.1 | 39<br>18.8 | 22<br>16.0 | 7<br>19.5 | 2<br>15.0 | 33<br>17.6   | 253<br>23.4 | —   |
|                                             | Score               | 19.2       | 14.3       | 16.4       | 19.1       | 20.1       | 18.8       | 16.0       | 19.5      | 15.0      | 17.6         | 18.3        | —   |

This table is to be read as follows: Twelve eighth grade children who had been one year or less in the Gary schools made an average score in spelling of 57.9 per cent. Eleven who had been in Gary between one and two years made an average score of 54.5 per cent., and so on. A group of children for whom no data could be secured made an average score of 41.6 per cent., while the average of the class, as a whole, was 53.1 per cent. The Ayres standard score for the grade is 76 per cent.

## THE GARY SCHOOLS

TABLE XCIV  
ABILITY IN LIST SPELLING AND NUMBER OF YEARS IN GARY

| ACCURACY<br>OF<br>SPELLING | NUMBER OF SEVENTH GRADE CHILDREN MAKING EACH ACCURACY SCORE, GROUPED ACCORDING TO |      |      |      |      |      |      |      |      |    |      | TOTAL<br>FREQUENCY |
|----------------------------|-----------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|----|------|--------------------|
|                            | YEARS SPENT IN GARY SCHOOLS                                                       |      |      |      |      |      |      |      |      |    |      |                    |
|                            | 1                                                                                 | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10 | x    |                    |
| 100%                       | 2                                                                                 | 1    | 1    | 3    | 1    | 1    | —    | —    | —    | —  | 2    | 11                 |
| 95                         | 4                                                                                 | 2    | —    | —    | 5    | 2    | —    | 1    | —    | —  | 1    | 15                 |
| 90                         | 3                                                                                 | 1    | 4    | 3    | 2    | 4    | 1    | 1    | —    | —  | 1    | 20                 |
| 85                         | 5                                                                                 | 1    | 1    | 2    | 4    | 1    | 4    | 1    | —    | —  | 3    | 22                 |
| 80                         | 2                                                                                 | 1    | —    | 2    | 3    | 4    | 1    | —    | —    | —  | 2    | 15                 |
| 75                         | —                                                                                 | 1    | 4    | 2    | 3    | 2    | 3    | —    | —    | —  | 1    | 16                 |
| 70                         | 3                                                                                 | 1    | 2    | 1    | 7    | 2    | 2    | —    | 1    | —  | —    | 21                 |
| 65                         | 1                                                                                 | 2    | 2    | 1    | 2    | 2    | —    | 3    | —    | —  | 1    | 12                 |
| 60                         | 2                                                                                 | 2    | 1    | 1    | 1    | 8    | 4    | 1    | —    | —  | 2    | 22                 |
| 55                         | 2                                                                                 | 3    | 1    | 4    | —    | 4    | 1    | 1    | —    | —  | 1    | 20                 |
| 50                         | 1                                                                                 | 1    | 4    | 2    | 1    | 2    | —    | —    | —    | —  | 1    | 13                 |
| 45                         | 1                                                                                 | 3    | —    | 3    | 1    | 2    | 3    | —    | —    | —  | 2    | 6                  |
| 40                         | 1                                                                                 | 2    | 4    | 2    | 2    | 2    | 1    | —    | 1    | —  | —    | 19                 |
| 35                         | —                                                                                 | 1    | 2    | —    | —    | 1    | —    | —    | —    | —  | —    | 12                 |
| 30                         | 3                                                                                 | 1    | 3    | 2    | —    | 2    | —    | 1    | —    | —  | 3    | 8                  |
| 25                         | —                                                                                 | 1    | 2    | 2    | —    | —    | 2    | —    | —    | —  | —    | 11                 |
| 20                         | —                                                                                 | 1    | —    | —    | —    | —    | 2    | —    | —    | —  | 2    | 7                  |
| 15                         | —                                                                                 | —    | —    | —    | —    | —    | 1    | —    | —    | —  | —    | 2                  |
| 10                         | —                                                                                 | —    | —    | —    | —    | —    | —    | —    | —    | —  | 3    | 6                  |
| 5                          | —                                                                                 | —    | —    | —    | —    | —    | —    | —    | —    | —  | —    | 1                  |
| 0                          | —                                                                                 | —    | —    | —    | —    | —    | 1    | —    | —    | —  | —    | 1                  |
| Total                      | 31                                                                                | 26   | 32   | 31   | 34   | 42   | 28   | 8    | 2    | —  | 26   | 280                |
| Average                    | 70.5                                                                              | 57.3 | 56.4 | 59.8 | 73.1 | 64.6 | 53.6 | 66.2 | 50.0 | —  | 55.8 | 61.9               |

TABLE XCIV—*Continued*

This table is to be read as follows: Of 260 seventh grade children, 31 were reported as having been in the Gary schools one year or less. Of these 31, two made 100 per cent. accuracy in the List Spelling Test, four made 95 per cent., three 90 per cent., and so on down to three who made but 25 per cent. The average score for the group was 70.5 per cent. The average score of the entire seventh grade was 61.9 per cent. X represents a group of 26 children for whom no information in regard to years spent in the Gary schools was available.

The results as a whole show no clear relation between children who have spent five or six years in the Gary schools and those who have just entered. Apparently the children who have received all their training in the Gary schools do as well as those who have received the major portion of their training elsewhere.

which the new children come. Finally, it would seem that the scores made by the children who started in the Gary schools when buildings were small and the system undeveloped have a tendency to be lower than the scores made by those who have had the benefit of recent improvements.

On the other hand, it may be that the quality of the material drawn to Gary at different years has varied greatly; that during certain years the newcomers have been more able, or better trained children, and that during other periods the new material has been of lesser ability. For a complete discussion of the results it would be necessary to determine not only the length of time in Gary, but the source from which the children are drawn. It is known that many of the workers in the steel mills come from small mill towns in Pennsylvania, and from rural communities in the South and West. In other words, the writer interprets the data to mean that prob-

ably the newcomers in Gary are drawn from small communities and have had poor educational training.

A study of the frequency with which each type of ability occurs in the different grades shows that the children who spell with perfect accuracy occur in every division from those containing the scores of children who have just arrived in Gary to the scores of those who have spent five years or more in the Gary schools, that children with grades higher than 80 per cent. (standard 76 per cent.) are found in considerable number in every group. In similar fashion, in every group will be found children who spell less than 30 per cent. of the words of the test correctly. Similar conditions could be shown for other tests. In other words, a child of great native capacity who has spent all his life in the Gary schools may attain a perfect score in the spelling tests in spite of the inefficiency of the general training.

#### STATES

The fourth group of major factors affecting performance is best described as the physical, mental, or emotional states of the children tested. Hunger, disease, fatigue affect performance, as do also fear, nervousness, interest, etc. However, there is no reason to think that the conditions at Gary with respect to all such factors differ from those in other cities except so far as the proportion of foreign children is greater at Gary than in other cities. In any city on any one day a few children are likely to have headaches, or to be otherwise indis-

## FACTORS AFFECTING PERFORMANCE 381

posed, a few children's emotional equilibrium will be upset by the idea of taking a test, and so on. But the results show that when tests are properly given, the entire number of scores which grossly misrepresent the abilities of the children is not more than ten per cent. of the total.

### PHYSIOLOGICAL FACTORS

Of the physiological factors affecting performance, little that is based upon positive knowledge can be said. There are few studies of the effects of left-handedness, defective eyesight, sickness, accidents, and similar conditions (which obviously must have an influence upon the functioning of brain and muscle), so that it is impossible to judge whether conditions in the Gary schools are better or worse than in other school systems. In general, any derangement or imperfection of the human mechanism will affect the performance of that individual in a test, and when that imperfection is a temporary defect, as a sick headache, or a sore finger, the individual's performance in a test may grossly misrepresent his true ability.<sup>1</sup> In general, also, the number of such special conditions should be fairly constant from city to city so that the effect of such factors at Gary should not be greater than in other cities.

### SUMMARY

In the foregoing pages the attempt has been made to array the evidence which proves that a child's perform-

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<sup>1</sup>See page 452.



ance in a standard test is determined by very many factors, of which ability is but one. Its discussions will have been in vain unless the reader understands that the meaning of it all is that the interpretation of the results of testing is a difficult matter at best, and becomes quite impossible unless the nature of the test itself and the conditions under which it is given are known. The thoughtful reader will appreciate the reason for the many warnings which appear throughout this report against careless comparisons from city to city.

On the other hand, this chapter will have been equally futile if it succeeds only in arousing in the reader's mind the suspicion that because of the ease with which variations in performance may be brought about, standard tests are unreliable and, therefore, valueless. It must never be forgotten that educational tests are as reliable as a physician's thermometer and no more so. They register with absolute definiteness and perfect exactness the precise performance of each child under the given conditions. The writer has used at Gary the standard tests which seem to him to be the best available and in the foregoing chapters of this report and in the appendix has arrayed as carefully and completely as possible the conditions under which they were given and scored. The reader should, therefore, be able to determine for himself the value of the material herein presented, and should not be led into the mistake of inferring from it either too little or too much.

## IX. CONCLUSIONS

**I**N THE foregoing chapters the attempt has been made to present in a strictly impartial manner the general as well as the detailed results obtained from the measurement of the products of classroom teaching at Gary. As far as possible inferences and conclusions have been omitted, and statements limited to facts.

The person in charge of an investigation, however, has superior opportunities to judge of the reliability of the results. He sees the responses of children and teachers to the testing situations at the time they are made. Week after week, he comes in contact with the ordinary routine of the school life under conditions less formal than at the times the tests are given. His observation of the workings of many intangible factors behind the scenes aid and influence him in interpreting the formal results.

Herein lies a source of danger. Human observation at best is faulty, and inferences based upon it may be grossly biased. The author feels, however, that in spite of this danger he would be doing less than his full duty if he did not give his personal interpretation of the results secured. Accordingly in this chapter his conclusions are recorded for the benefit of those who may desire to know them.

The general conclusion of the author is that the product of classroom teaching of the fundamentals is, at Gary, poor in quality and inadequate in amount; it approximates in character the product of the poorer conventional schools, and reveals in no particular the slightest indication that it has been affected either favorably or unfavorably by the enriched curriculum, or other special features of the Gary schools. The progress from grade to grade is relatively small, the final levels of achievement reached are comparatively low, and the differences between the results of simple and complex tests in any one subject increase progressively. The entire investigation reveals many and consistent evidences of careless work, imperfectly developed habits, and marked lack of achievement.

The reader should, however, not infer too much from the preceding statement. In the writer's judgment the results do not mean at all that the movement for the socialization of school work is wrong, that the new type of organization is injurious, and that a modernized program is a failure. They do mean simply and solely that none of those features of the Gary experiment which appeal so strongly to the imagination and sympathies of the casual visitor have operated effectively enough to offset the inadequate control of the organization and administration of the system which the other investigators have brought to light.

In other words, results of tests reveal conditions but do not show causes. While the results prove plainly

that the products of classroom teaching in the fundamentals are poor, the reader should not allow his mind to associate in a casual relationship the fundamental theories of a modernized school and inefficient teaching. Neither should he be misled by "explanations" of the results. It would be most unscientific, with an adequate explanation at hand, to assume that the effects noted are due to the operation of a remote and questionable cause. Present results prove merely that at Gary certain vital factors in school work have been neglected, but the reader should not decide what those factors are until he has read the other volumes of the report.<sup>1</sup>

The writer does not believe that the present defects of administration are in the slightest degree inherent in the attempt to enrich the school curriculum or to modify school practice so that it will appeal to the interest of the child and satisfy the natural instincts of his developing life. Therefore, if this report should operate to retard the progressive movement of which the experiment at Gary is an expression, he would feel that a very great and needless injury had been done American education. Although when the investigation was undertaken, it was expected that decisive results would be secured, it must now be emphasized again and again that the effects of the newer ideals of education have not been measured, because at Gary these ideals are operating under such conditions that they play little or no part in determining the product of classroom teaching.

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<sup>1</sup>See report on Organization and Administration.

On the other hand, the benefit of this report may be great if it makes clear that in education, as in other walks of life, it is not enough to take for granted that because aims are high, intentions good, and theory apparently sound, satisfactory results are sure to follow. The courage to attack experimentally great educational problems cannot be too much commended, but experiments unmeasured and unchecked, except by the subjective opinions of their originators, are to be condemned.

After all, the message of this report turns out to be not that the Gary schools are good, bad or indifferent, but that by measurement, properly used, a superintendent who is concentrating his attention upon certain features of a constructive experiment may determine whether or not he has left unnoticed certain other features of equal or greater importance.

## **APPENDIX A**



## CONTENTS

|                                                                                                                         | PAGE |
|-------------------------------------------------------------------------------------------------------------------------|------|
| I. ATTENDANCE AND DAYS TESTS WERE<br>GIVEN . . . . .                                                                    | 391  |
| II. COMPARATIVE DATA ON THE EFFECTS OF<br>MATURITY AND TRAINING . . . . .                                               | 397  |
| III. ILLUSTRATION OF METHOD OF MAKING<br>THE SCHOOL TO SCHOOL COMPARISONS,<br>BASED ON SCORES FOR HANDWRITING . . . . . | 400  |
| IV. WORDS MISSPELLED IN EIGHTH GRADE<br>COMPOSITIONS . . . . .                                                          | 406  |
| V. SAMPLE GARY COMPOSITIONS ARRANGED AS<br>A SCALE . . . . .                                                            | 416  |
| VI. COMPOSITIONS FROM DIFFERENT SURVEYS<br>VALUED AT APPROXIMATELY 50 HILLEGAS . . . . .                                | 430  |
| VII. VOCABULARY OF EIGHTH GRADE COMPOSI-<br>TIONS. . . . .                                                              | 434  |
| VIII. DETERMINATION OF CRITICAL PARAGRAPH<br>IN GRAY'S ORAL READING SCALE . . . . .                                     | 438  |
| IX. METHOD OF SCORING READING AND RE-<br>PRODUCTION TESTS. . . . .                                                      | 443  |
| X. VARIABILITY AND ITS SIGNIFICANCE. . . . .                                                                            | 452  |
| XI. STATISTICAL TERMS AND METHODS . . . . .                                                                             | 472  |





# I. ATTENDANCE AND DAYS TESTS WERE GIVEN

TABLE I  
ATTENDANCE

Comparison of Class Attendance Based on Two Trials of an Addition Test (Series B) April 25 and May 31. Class No. 28  
Froebel, Grade 4A Was Selected. The Remaining Classes Were Chosen at Random from the Sixth Grade Records.

| SCHOOL    | CLASS<br>No. | OFFICIAL<br>GRADE<br>IN<br>JUNE | OFFICIAL<br>MEMBER-<br>SHIP | NO. ACTUALLY<br>PRESENT |        | NUMBER CHILDREN PRESENT |                               |                               |                  |    | NOT FOUND<br>ON OFFICIAL<br>LIST FOR<br>GIVEN<br>CLASS |
|-----------|--------------|---------------------------------|-----------------------------|-------------------------|--------|-------------------------|-------------------------------|-------------------------------|------------------|----|--------------------------------------------------------|
|           |              |                                 |                             | April 25                | May 31 | Both<br>Trials          | April 25<br>But Not<br>May 31 | May 31<br>But Not<br>April 25 | Neither<br>Trial |    |                                                        |
|           |              |                                 |                             |                         |        |                         |                               |                               |                  |    |                                                        |
| Froebel   | 28           | 4A                              | 34                          | 25                      | 32     | 22                      | 3                             | 10                            | 2                | 3  |                                                        |
| Froebel   | 39           | 6B                              | 31                          | 29                      | 21     | 20                      | 9                             | 1                             | 6                | 5  |                                                        |
| Emerson   | 12           | 6A                              | 38                          | 33                      | 35     | 32                      | 1                             | 3                             | 4                | 2  |                                                        |
| Jefferson | 13           | 6C                              | 36                          | 34                      | 31     | 27                      | 7                             | 4                             | 1                | 3  |                                                        |
| Beveridge | 11           | 6A-B-C                          | 45                          | 28                      | 33     | 27                      | 1                             | 6                             | 11               | 0  |                                                        |
| Total     | —            | —                               | 184                         | 149                     | 152    | 128                     | 21                            | 24                            | 24               | 13 |                                                        |
| Per cent. | —            | —                               | 100                         | 81                      | 82     | 69                      | 11                            | 14                            | 13               | 7  |                                                        |

This table is to be read as follows: Class No. 28 in the Froebel school was given the official grade of 4A in June, 1916. The official class membership was 34. In April, 25 children were present at the time the class was tested, and in May, 32. But 22 children were present for both trials. Three children were present April 25 but not May 31. Ten children were present May 31 but not April 25. Two children were not present either day. Three of the children actually tested in the class are not given in the official list for this class.

Superintendent Wirt has called attention to the fact that both April 25 and May 31 are days immediately following religious or national holidays. However, the percentages of attendance on these days were 78 and 83%. The average for 19 days was 83%. See also next page.

TABLE I—A  
COMPARISON OF CLASS ATTENDANCE ON TWO SUCCESSIVE TEST DAYS

Table Prepared According to the Plan of Table L, Test Days Distributed from March to May. The Data for the First Comparison Given in Full, the Others by Summary only.

| SCHOOL                       | CLASS No. | OFFICIAL GRADE IN JUNE | OFFICIAL MEMBER-SHIP | No. ACTUALLY PRESENT |        | NUMBER CHILDREN PRESENT |                    |                    |             |    | NUMBER PRESENT BUT NOT ON OFFICIAL LIST FOR CLASS |
|------------------------------|-----------|------------------------|----------------------|----------------------|--------|-------------------------|--------------------|--------------------|-------------|----|---------------------------------------------------|
|                              |           |                        |                      | 1st day              | 2d day | Both Days               | 1st day but not 2d | 2d day but not 1st | Neither day |    |                                                   |
| Froebel.....                 | 28        | 4A                     | 34                   | 30                   | 30     | 29                      | 1                  | 1                  | 10          | 7  |                                                   |
| ".....                       | 39        | 6B                     | 31                   | 32                   | 31     | 28                      | 4                  | 3                  | 2           | 6  |                                                   |
| Emerson.....                 | 12        | 6A                     | 38                   | 29                   | 32     | 28                      | 1                  | 4                  | 6           | 1  |                                                   |
| Jefferson.....               | 13        | 6C                     | 36                   | 36                   | 34     | 34                      | 2                  | 0                  | 4           | 4  |                                                   |
| Beveridge.....               | 11        | 6A-B-C                 | 45                   | 40                   | 37     | 36                      | 4                  | 1                  | 5           | 1  |                                                   |
| Total.....                   |           |                        | 184                  | 167                  | 164    | 155                     | 12                 | 9                  | 27          | 19 |                                                   |
| Per cent. <sup>1</sup> ..... |           |                        | 100                  | 90                   | 89     | 84                      | 6                  | 5                  | 15          | 10 |                                                   |
| Per cent. <sup>2</sup> ..... |           |                        | 100                  | 83                   | 85     | 73                      | 10                 | 13                 | 17          | 13 |                                                   |
| Per cent. <sup>3</sup> ..... |           |                        | 100                  | 86                   | 78     | 76                      | 10                 | 9                  | 12          | 7  |                                                   |
| Per cent. <sup>4</sup> ..... |           |                        | 100                  | 78                   | 86     | 72                      | 6                  | 14                 | 16          | 8  |                                                   |

<sup>1</sup>First day, March 30; second day, April 4-5. Fourth and fifth trials of test of copying figures.

<sup>2</sup>First day, April 11; Kansas Silent Reading Test; second day, April 13, Trabue, Scale B.

<sup>3</sup>First day, April 11; Kansas Silent Reading Test I, second day, April 27, Kansas Silent Reading Test II. Class of Froebel is omitted from the tabulation as it did not take the second test.

<sup>4</sup>First day, May 2-3, Spelling, List Test; second day, May 4, Spelling, Dictation Test.

The table is to be read in the same fashion as Table I.

TABLE II  
LIST OF TESTS AND DAYS WHEN GIVEN

| DATE     | DAY OF WEEK | SUBJECT     | NAME OF TEST                                     | REMARKS                           |
|----------|-------------|-------------|--------------------------------------------------|-----------------------------------|
| March 23 | Thursday    | General     | Rate of Copying Figures                          | Trial I                           |
| March 24 | Friday      | General     | Rate of Copying Figures                          | Grades 2-12                       |
| March 30 | Thursday    | General     | Rate of Copying Figures                          | Trials 2, 3, and 4                |
| April 31 | Friday      | General     | Rate of Copying Figures                          | Trial 5                           |
| April 4  | Tuesday     | General     | Rate of Copying Figures                          | Trials 1 and 2                    |
| April 4  | Tuesday     | General     | Rate of Copying Figures                          | Grades 2-12                       |
| April 11 | Wednesday   | General     | Cancellation of Triangles                        | No. 1, Grades 3-12                |
| April 13 | Thursday    | Reading     | Kansas Silent Reading Tests                      | Scale B, Grades 4-12              |
| April 14 | Friday      | Language    | Trabue Language Scales                           | Scale D, " 4-12                   |
| April 25 | Tuesday     | Arithmetic  | Courts Standard Research Tests, Series B         | No. 1 and 2, Form 3,              |
| April 26 | Wednesday   | Arithmetic  | Courts Standard Research Tests, Series B         | Grades 4-12                       |
| May 27   | Thursday    | Reading     | Kansas Silent Reading Tests                      | No. 3 and 4, Grades 4-12          |
| May 2    | Tuesday     | Spelling    | Cleveland List Tests                             | No. 2, Grades 4, 5, 6, 7 and 8    |
| May 3    | Wednesday   | Spelling    | Courts Dictation Tests                           | No. 3, Grades 8, 9, 10, 11 and 12 |
| May 4    | Thursday    | Spelling    | Cleveland Writing Test                           | Grades 2-12                       |
| May 11   | Thursday    | Writing     | Trabue Language Scales                           | " 2-12                            |
| May 16   | Tuesday     | Language    | Cleveland Arithmetic Tests                       | Grades 3-12                       |
| May 18   | Thursday    | Arithmetic  | Cleveland Arithmetic Tests                       | Scale E, Grades 4-12              |
| May 19   | Friday      | Arithmetic  | Gray's Oral Reading Scale                        | Sets C, G, H, L and O             |
| May 23   | Tuesday     | Reading     | Gray's Oral Reading Scale                        | Grades 3-12                       |
| May 24   | Wednesday   | Reading     | Gray's Oral Reading Scale                        | Grades 3-8                        |
| May 25   | Thursday    | Reading     | Gray's Oral Reading Scale                        | " 9-8                             |
| May 28   | Monday      | Language    | Trabue Language Scales                           | " 9-8                             |
| May 31   | Wednesday   | Arithmetic  | Courts Standard Research Tests, Series B, Form 4 | Scale C                           |
| June 1   | Thursday    | Arithmetic  | Courts Standard Research Tests, Series B, Form 4 | Series B, Nos. 1 and 2            |
| June 8   | Thursday    | Reading     | Reproduction Tests                               | Grades 4-8                        |
| June 8   | Thursday    | Composition | Denver Composition Tests                         | No. 3 and 4                       |
| June 9   | Friday      | Composition | Denver Composition Tests                         | Grades 4-12                       |
|          |             |             |                                                  | Grades 2-12                       |
|          |             |             |                                                  | " 4-12                            |
|          |             |             |                                                  | " 4-12                            |

TABLE II—*Continued*<sup>1</sup>

The table is to be read as follows:

On March 23, Thursday, a general test was given, known as a test of rate of copying figures. This was the first trial of the test and grades 2 to 12 were tested. It proved impossible for the examiners to reach all the classes in their academic classrooms on this day, however, so the few remaining classes were visited the next day.

The table shows that 12 different kinds of tests were given; that some of the tests were given more than once; that on the average one class in the upper elementary grades was tested 21 times in 11 weeks of school work; that in general most of the testing was done on Tuesdays and Thursdays; that on 5 days it was necessary to visit certain classes on Wednesday instead of on Tuesday, and on Friday instead of on Thursday; that on 2 occasions only were the tests given mainly on any other days than Tuesdays and Thursdays.

The disturbance of class work by the giving of a test varied from 10 minutes to 40 minutes. Taking 25 minutes as the average time (probably an over-estimate), and 3 hours of school work per day as the total time given to academic studies, the interruptions to be charged against the testing work decreased the regular class time by approximately 6 per cent. during the testing period of 11 weeks, or a little less than 2 per cent. for the full year. This was probably much more than offset by the stimulus of the testing work to both teachers and pupils.

TABLE III  
ORGANIZATION

| GRADE IN<br>JUNE, 1916 | FROEHL       |                                           | EMERSON      |                                           | JEFFERSON    |                                           | BEVERIDGE    |                                           | TOTAL |
|------------------------|--------------|-------------------------------------------|--------------|-------------------------------------------|--------------|-------------------------------------------|--------------|-------------------------------------------|-------|
|                        | Class<br>No. | No.<br>Children<br>Enrolled<br>June, 1916 | Class<br>No. | No.<br>Children<br>Enrolled<br>June, 1916 | Class<br>No. | No.<br>Children<br>Enrolled<br>June, 1916 | Class<br>No. | No.<br>Children<br>Enrolled<br>June, 1916 |       |
| 2C                     | 9            | 40                                        | 6            | 21                                        | 5            | 36                                        | 4            | 25                                        | 168   |
| 2C                     | 14           | 46                                        | —            | —                                         | —            | —                                         | —            | —                                         | 78    |
| 2B                     | 15           | 38                                        | 4            | 18                                        | —            | —                                         | 4            | 22                                        | 78    |
| 2A                     | 18           | 34                                        | 4            | 20                                        | 3            | 46                                        | 5            | 39                                        | 139   |
| Mixed 2A and 3)*       | 28           | 25                                        | —            | —                                         | —            | —                                         | —            | —                                         | 25    |
| 3C                     | 16           | 40                                        | 7            | 18                                        | 7            | 39                                        | 6            | 40                                        | 168   |
| 3C                     | 23           | 31                                        | —            | —                                         | —            | —                                         | —            | —                                         | —     |
| 3B                     | 17           | 40                                        | 7            | 22                                        | 6            | 36                                        | 7            | 17                                        | 152   |
| 3A                     | 20           | 37                                        | —            | —                                         | —            | —                                         | —            | —                                         | —     |
| 3A                     | 19           | 39                                        | 8            | 20                                        | 8            | 39                                        | 7            | 28                                        | 168   |
| Mixed 3A, 4, 5)*       | 21           | 42                                        | —            | —                                         | —            | —                                         | —            | —                                         | 28    |
| Colored 3*             | 27           | 28                                        | —            | —                                         | —            | —                                         | —            | —                                         | 15    |
| Colored 4*             | 36           | 12                                        | —            | —                                         | —            | —                                         | —            | —                                         | 12    |
| 4C                     | 35           | 39                                        | 8            | 23                                        | 9            | 36                                        | 8            | 19                                        | 153   |
| 4C                     | 32           | 36                                        | —            | —                                         | —            | —                                         | —            | —                                         | —     |
| 4B                     | 22           | 33                                        | —            | —                                         | 12           | 31                                        | 8            | 28                                        | 92    |
| 4B                     | 24           | 33                                        | —            | —                                         | —            | —                                         | —            | —                                         | —     |

TABLE III (Continued)

|       |           |       |    |     |    |     |    |     |       |
|-------|-----------|-------|----|-----|----|-----|----|-----|-------|
| 4A    | 28        | 34    | 9  | 41  | 12 | 18  | 9  | 30  | 123   |
| 5C    | 29        | 41    | —  | —   | 11 | 44  | 10 | 13  | 169   |
| 5C    | 30        | 40    | —  | —   | —  | —   | —  | —   | 68    |
| 5C    | 31        | 35    | —  | —   | 10 | 9   | 10 | 24  | 170   |
| 5A    | 37        | 42    | 11 | 39  | 10 | 34  | 10 | 16  | 81    |
| 5A    | 33        | —     | —  | —   | 15 | 39  | 11 | 20  | 99    |
| 6C    | 38        | 25    | —  | —   | 13 | 36  | —  | 9   | 85    |
| 6B    | 39        | 31    | —  | —   | —  | —   | —  | —   | 69    |
| 6B    | 41        | 28    | —  | —   | —  | —   | —  | 16  | 38    |
| 7C    | 40        | 31    | 12 | 38  | 16 | 42  | 11 | 10  | 181   |
| 7C    | 42        | 31    | —  | —   | 17 | 17  | 12 | 16  | 36    |
| 7B    | —         | —     | 10 | 29  | 17 | 41  | 12 | —   | 108   |
| 7A    | 43        | 27    | 13 | 40  | 14 | 22  | —  | —   | 222   |
| 8B    | 44        | 35    | 15 | 36  | 17 | 36  | —  | —   | 115   |
| 8A    | 45        | 16    | 14 | 35  | 18 | —   | —  | —   | 85    |
| 8A    | 46        | 21    | —  | 30  | —  | —   | —  | —   | 54    |
| 9     | 47        | 29    | —  | 31  | —  | —   | —  | —   | —     |
| 9     | 49 and 51 | 25    | —  | 85  | —  | —   | —  | —   | —     |
| 10    | —         | 27    | —  | 33  | —  | —   | —  | —   | —     |
| 11    | —         | 27    | —  | 37  | —  | —   | —  | —   | —     |
| 12    | —         | 17    | —  | 37  | —  | —   | —  | —   | —     |
| Total | —         | 1,219 | —  | 681 | —  | 601 | —  | 381 | 2,882 |

\* Omitted in city wide tabulations.

## II. SCORES FROM VARIOUS SURVEYS TABULATED TO SHOW THE EFFECTS OF MATURITY ON TRAINING

TABLE IV

### RATE OF DEVELOPMENT OF ABILITY IN VARIOUS TESTS

Based Upon Scores of Cities *Other* Than Gary,

Comparison of Rate of Development of Rate Scores in Various Tests. Generalized City Wide Scores Expressed Both in Specific Units and in Terms of Relative Development (Percentage of Eighth Grade Score). Tests Classified According to the Nature of Development.

#### CLASS A

Motor and mental activities fully habituated. Rate of mental activity much greater than possible motor activity, so that the rate of work is determined by the rate of the motor.

| TESTS                         | ACTUAL SCORES IN GRADES |     |      |      |      |      |      |
|-------------------------------|-------------------------|-----|------|------|------|------|------|
|                               | 2                       | 3   | 4    | 5    | 6    | 7    | 8    |
| Copying Figures.....          | —                       | 63  | 75   | 84   | 92   | 100  | 108  |
| Rate of Oral Reading.....     | 117                     | 144 | 176  | 175  | 189  | 198  | 192  |
| Multiplication Tables.....    | —                       | 6.5 | 12.0 | 15.5 | 16.6 | 17.7 | 19.0 |
|                               | RELATIVE DEVELOPMENT    |     |      |      |      |      |      |
| Gary Average from p. 363..... | —                       | 60  | 72   | 82   | 91   | 97   | 100  |
| Copying Figures.....          | —                       | 58  | 69   | 78   | 85   | 92   | 100  |
| Rate of Oral Reading.....     | 61                      | 75  | 92   | 91   | 99   | 103  | 100  |
| Multiplication Tables.....    | —                       | 34  | 58   | 82   | 87   | 93   | 100  |

The data above were derived from the following tables: Copying Figures, Bulletin No. 2, Courtis Standard Research Tests. Rate of Oral Reading, average scores paragraphs 1 and 4, Gray's Reading Scale St. Louis Survey, see this report, Table LXVI, page 280. Multiplication Tables, Cleveland Survey, see this report, Table XXXVII, page 162.



TABLE IV (Continued)

## CLASS B

Activities in which the motor is dependent upon and controlled by the mental but in which the mental ability at Gary is mainly the results of general and not specific training.

| Tests                          | ACTUAL SCORES IN GRADES |      |      |      |      |      |      |
|--------------------------------|-------------------------|------|------|------|------|------|------|
|                                | 2                       | 3    | 4    | 5    | 6    | 7    | 8    |
| Writing, Free Choice. . . . .  | 30.6                    | 43.8 | 51.2 | 59.1 | 62.8 | 67.9 | 73.0 |
| Writing, Composition. . . . .  | —                       | —    | 45   | 49   | 53   | 58   | 65   |
| Writing, Reproduction. . . . . | —                       | 11   | 14   | 17   | 19   | 21   | 23   |
| Adding. . . . .                | —                       | —    | 7.4  | 8.6  | 9.8  | 10.9 | 11.6 |
|                                | RELATIVE DEVELOPMENT    |      |      |      |      |      |      |
| Gary Average. . . . .          | —                       | 37   | 52   | 64   | 76   | 88   | 100  |
| Writing, Free Choice. . . . .  | 42                      | 60   | 70   | 81   | 86   | 93   | 100  |
| Writing, Composition. . . . .  | —                       | —    | 69   | 75   | 82   | 89   | 100  |
| Writing, Reproduction. . . . . | —                       | 48   | 61   | 74   | 83   | 91   | 100  |
| Adding. . . . .                | —                       | —    | 64   | 74   | 84   | 94   | 100  |

The data above were derived from the following tables: Writing, Free choice (Freeman), see this report, Table IV, page 41. Writing, Composition and Reproduction, see Fourteenth Yearbook of the National Society for the Study of Education, p. 56. Adding, Bulletin No. 4, Courtis Standard Research Tests, see this report, Table XXXVI, page 153.

TABLE IV (Concluded)

## CLASS C

Miscellaneous scores in which rate of work is largely determined by training and in which variations in rate of growths are shown.

| Test                   | ACTUAL SCORES IN GRADES |     |     |     |      |      |      |      |      |      |      |
|------------------------|-------------------------|-----|-----|-----|------|------|------|------|------|------|------|
|                        | 2                       | 3   | 4   | 5   | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| Reading.....           | 108                     | 126 | 144 | 168 | 192  | 216  | 240  | —    | —    | —    | —    |
| Division.....          | —                       | .6  | 4.6 | 6.1 | 8.2  | 9.6  | 10.7 | —    | —    | —    | —    |
| Simple Fractions.....  | —                       | .6  | 1.9 | 3.2 | 4.8  | 5.5  | 6.4  | 7.3  | 8.1  | 8.3  | 8.5  |
| Complex Fractions..... | —                       | —   | 1.2 | 5.4 | 7.6  | 8.4  | 8.5  | 8.5  | 8.5  | 8.5  | 8.5  |
| Trabue.....            | —                       | 6.0 | 8.0 | 9.6 | 11.0 | 12.3 | 13.3 | 14.2 | 15.3 | 15.8 | 16.2 |

| Test                   | RELATIVE DEVELOPMENT |    |    |    |    |    |     |     |     |     |     |
|------------------------|----------------------|----|----|----|----|----|-----|-----|-----|-----|-----|
|                        | 45                   | 52 | 60 | 70 | 80 | 90 | 100 | —   | —   | —   | —   |
| Reading.....           | —                    | 6  | 43 | 57 | 77 | 90 | 100 | —   | —   | —   | —   |
| Division.....          | —                    | 9  | 30 | 50 | 75 | 86 | 100 | 114 | 126 | 130 | 133 |
| Simple Fractions.....  | —                    | —  | 14 | 64 | 89 | 99 | 100 | 100 | 100 | 100 | 100 |
| Complex Fractions..... | —                    | —  | —  | —  | —  | —  | —   | 107 | 115 | 119 | 122 |
| Trabue.....            | —                    | 45 | 60 | 72 | 83 | 92 | 100 | —   | —   | —   | —   |

The above data were derived from the following tables: Reading (Starch), see this report, Table LXVII, page 282. Division, see Bulletin No. 4, Courtis Standard Research Tests. Simple and Complex Fractions, Cleveland Survey, see this report, Table XXXIX, page 169. Trabue, Standard Scores, see this report, Table LXXI, page 296.

### III. SCHOOL TO SCHOOL COMPARISON FOR HANDWRITING

The tables are to be read as follows: In the free choice test in handwriting, the lowest class measured in the Froebel school was class No. 32. This was ranked as of the 4C grade in June, 1916.

The generalized city wide score in the free choice handwriting test for the 4C grade was 37 letters per minute with a quality of 31 Ayres. The median rate of writing of class No. 32 Froebel was 43.8 letters per minute with a quality of 26.3 Ayres. That is, the rate of writing of the class was 6.8 letters per minute higher than the city wide score and 4.7 points lower in quality. As both of these differences exceed .1 of the city wide scores they are starred (\*) in the table.

In Froebel four classes had scores which were markedly above the city wide scores in rate, and four classes had scores which were markedly below the city wide scores. The variation in the remaining classes was considered to be negligible.



TABLE V (Continued)

| GRADE | GENERALIZED CITY SCORE |         | JEFFERSON |       |         |            |         |           | BEVERIDGE |         |            |         |  |  |
|-------|------------------------|---------|-----------|-------|---------|------------|---------|-----------|-----------|---------|------------|---------|--|--|
|       | Rate                   | Quality | CLASS NO. | SCORE |         | DIFFERENCE |         | CLASS NO. | SCORE     |         | DIFFERENCE |         |  |  |
|       |                        |         |           | Rate  | Quality | Rate       | Quality |           | Rate      | Quality | Rate       | Quality |  |  |
| 4C    | 37                     | 31      | 9         | 42.0  | 34.6    | +5.0*      | +3.6*   | 8         | 45.0      | 36.2    | +8.0*      | +5.2*   |  |  |
| 4B    | 46                     | 32      | 12        | 50.0  | 34.2    | +4.0       | +2.2    | 8         | 46.0      | 31.8    | 0          | -2.2    |  |  |
| 4A    | 51                     | 33      | 12        | 50.0  | 33.4    | -1.0       | +1.4    | 9         | 55.0      | 29.1    | +4.0       | -2.9    |  |  |
| 5C    | 56                     | 33      | 11        | 54.0  | 28.6    | -2.5       | -2.0    | 9         | 66.6      | 30.0    | +10.6*     | -3.0    |  |  |
| 5B    | 60                     | 34      | 10        | 62.5  | 32.0    | +2.5       | -2.8    | 10        | 63.0      | 29.2    | +3.0       | -1.8*   |  |  |
| 5A    | 64                     | 35      | 10        | 62.5  | 32.2    | -1.7       | +5.0*   | 10        | 70.0      | 42.5    | +6.0       | +7.5*   |  |  |
| 5A    | 64                     | 35      | 15        | 69.0  | 32.2    | -1.7       | +5.0*   | 10        | 70.0      | 42.5    | +6.0       | +7.5*   |  |  |
| 6C    | 68                     | 36      | 13        | 60.0  | 37.8    | -8.0*      | +1.8    | 11        | 72.5      | 36.3    | +4.5       | +3.0    |  |  |
| 6B    | 72                     | 37      | —         | —     | —       | —          | —       | 11        | 75.0      | 40.0    | +3.0       | +4.0*   |  |  |
| 6A    | 76                     | 38      | —         | —     | —       | —          | —       | 11        | 71.6      | 42.0    | +4.4       | +6.0*   |  |  |
| 7C    | 79                     | 39      | 16        | 82.1  | 37.5    | +3.1       | -1.5    | 12        | 82.5      | 45.0    | +3.5       | —       |  |  |
| 7C    | 79                     | 39      | 17        | 85.0  | 36.0    | +6.0       | -3.0    | 12        | 88.8      | 44.0    | +6.8       | +3.0    |  |  |
| 7B    | 82                     | 41      | —         | —     | —       | —          | —       | 12        | 87.5      | 45.8    | +1.5       | +3.8    |  |  |
| 7A    | 86                     | 42      | 14        | 87.0  | 45.3    | +1.0       | +3.3    | —         | —         | —       | —          | —       |  |  |
| 7A    | 86                     | 42      | 17        | 85.0  | 40.0    | -1.0       | -2.0    | —         | —         | —       | —          | —       |  |  |
| 8A    | 96                     | 44      | 18        | 105.0 | 44.4    | +9.0       | +4.4    | —         | —         | —       | —          | —       |  |  |

All differences marked with a star (\*) are more than .1 the generalized city wide score.



## APPENDIX A

TABLE VI (Continued)

| GRADE | GENERAL-<br>IZED<br>CITY<br>SCORE | FROBEL       |       |       | EMERSON      |       |       | JEFFERSON    |       |       | BEVERIDGE    |       |       |
|-------|-----------------------------------|--------------|-------|-------|--------------|-------|-------|--------------|-------|-------|--------------|-------|-------|
|       |                                   | Class<br>No. | Score | Diff. | Class<br>No. | Score | Diff. | Class<br>No. | Score | Diff. | Class<br>No. | Score | Diff. |
| 7B    | 38                                | —            | —     | —     | 10           | 34.1  | -3.9* | —            | —     | —     | 12           | 42.5  | +4.5* |
| 7A    | 38                                | 43           | 39.2  | +1.2  | 13           | 40.0  | +2.0  | 14           | 45.4  | +7.4* | 12           | 45.0  | +7.0* |
| 7A    | 38                                | —            | —     | —     | —            | —     | —     | 17           | 42.9  | +4.9* | —            | —     | —     |
| 7A    | 38                                | 44           | 38.7  | +1.7  | —            | —     | —     | —            | —     | —     | —            | —     | —     |
| 8B    | 39                                | —            | —     | —     | 15           | 40.0  | +1.0  | —            | —     | —     | —            | —     | —     |
| 8A    | 39                                | {45          | 36.4  | -2.6  | 14           | {42.7 | +3.7  | 18           | 46.1  | +7.1* | —            | —     | —     |
| 8A    | 39                                | {45          | 35.0  | -4.0* | —            | —     | -1.1  | —            | —     | —     | —            | —     | —     |
| 8A    | 39                                | {46          | 38.1  | -1.3  | —            | —     | —     | —            | —     | —     | —            | —     | —     |
| 8A    | 39                                | {46          | 37.7  | -1.3  | —            | —     | —     | —            | —     | —     | —            | —     | —     |
| 9     | 40                                | —            | 36.0  | -2.0  | —            | 39.1  | -.9   | —            | —     | —     | —            | —     | —     |
| 10    | 41                                | —            | 36.9  | -4.1  | —            | 42.4  | +1.4  | —            | —     | —     | —            | —     | —     |
| 11    | 42                                | —            | 38.1  | -3.9  | —            | 49.2  | +7.2* | —            | —     | —     | —            | —     | —     |
| 12    | 43                                | —            | 38.6  | -4.4* | —            | 41.8  | -1.2  | —            | —     | —     | —            | —     | —     |

All differences marked with a star (\*) are more than .1 the generalized city wide score.

TABLE VII  
HANDWRITING—COMPOSITION

| GRADE | GENERALIZED CITY SCORE | FROEDEL   |       |        | EMERSON   |       |       | JEFFERSON |       |       | BEVERIDGE |       |        |
|-------|------------------------|-----------|-------|--------|-----------|-------|-------|-----------|-------|-------|-----------|-------|--------|
|       |                        | Class No. | Score | Diff.  | Class No. | Score | Diff. | Class No. | Score | Diff. | Class No. | Score | Diff.  |
| 4C    | 31                     | 22        | 33.5  | +2.5   | —         | —     | —     | 9         | 32.8  | +1.8  | 8         | 27.0  | -4.0*  |
| 4C    | 31                     | 22        | 25.6  | +5.4*  | —         | —     | —     | 12        | 32.2  | —     | 8         | 27.1  | -4.9*  |
| 4B    | 32                     | 24        | 33.0  | +1.0   | —         | —     | —     | 12        | 31.4  | +2    | 9         | 30.0  | -2.0   |
| 4A    | 33                     | 28        | 34.3  | +2.3   | 9         | 33.8  | +1.8  | 11        | 33.6  | +6    | 9         | 40.0  | +7.0*  |
| 5C    | 33                     | 29        | 33.7  | +2.7   | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 5C    | 33                     | 30        | 36.4  | +3.4*  | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 5C    | 33                     | 31        | 36.4  | +5.0*  | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 5B    | 34                     | 31        | 28.0  | -1.0   | —         | —     | —     | 10        | 40.0  | +6.0* | 10        | 29.0  | -5.0*  |
| 5A    | 35                     | 37        | 37.5  | +2.5   | 11        | 37.5  | +2.5  | 15        | 39.1  | +4.1* | 10        | 32.0  | -3.0*  |
| 5A    | 35                     | 33        | —     | —      | —         | —     | —     | 13        | 32.3  | -2.7  | 11        | 45.0  | +13.0* |
| 6C    | 36                     | 37        | 37.7  | +1.7   | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 6B    | 37                     | 39        | 36.5  | +1.5   | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 6B    | 37                     | 40        | 37.5  | +2     | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 6B    | 37                     | 41        | 36.8  | —      | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 6A    | 37                     | 42        | 37.7  | +1.7   | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 7C    | 38                     | —         | —     | —      | 12        | 37.5  | +5    | —         | —     | —     | —         | —     | —      |
| 7C    | 38                     | —         | —     | —      | —         | —     | —     | 17        | 36.3  | -1.7  | 11        | 36.6  | —      |
| 7B    | 39                     | —         | —     | —      | —         | —     | —     | 16        | 37.6  | —     | 12        | 38.3  | +4.3   |
| 7A    | 40                     | 43        | 38.0  | -2.0   | 10        | 43.8  | +4.8* | —         | —     | —     | —         | —     | —      |
| 7A    | 40                     | 44        | 40.0  | —      | 13        | 45.5  | +5.5* | 17        | 41.0  | +1.0  | 12        | 40.0  | +1.0   |
| 8C    | 41                     | —         | —     | —      | —         | —     | —     | 14        | 38.0  | -2.0  | —         | —     | —      |
| 8B    | 42                     | —         | —     | —      | 15        | 35.8  | -6.2* | —         | —     | —     | —         | —     | —      |
| 8A    | 44                     | 45        | 36.6  | -7.4*  | 14        | 45.0  | +1.0  | 18        | 40.0  | -4.0  | —         | —     | —      |
| 8A    | 44                     | 46        | 43.3  | -7.7   | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 9     | 46                     | —         | 39.7  | -6.3*  | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 10    | 50                     | —         | 47.5  | -2.5   | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 11    | 51                     | —         | 42.5  | -8.5*  | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 12    | 51                     | —         | 40.0  | -11.0* | —         | —     | —     | —         | —     | —     | —         | —     | —      |

\*All differences marked with a star (\*) are more than .1 the generalized score.



## APPENDIX A

TABLE VI (Continued)

| GRADE | GENERAL-<br>MED<br>CITY<br>SCORE | FROEDEL      |       |       | EMERSON      |        |       | JEFFERSON    |       |       | BEVERIDGE    |       |       |
|-------|----------------------------------|--------------|-------|-------|--------------|--------|-------|--------------|-------|-------|--------------|-------|-------|
|       |                                  | Class<br>No. | Score | Diff. | Class<br>No. | Score  | Diff. | Class<br>No. | Score | Diff. | Class<br>No. | Score | Diff. |
| 7B    | 38                               | 43           | —     | —     | 10           | 34.1   | -3.9* | —            | —     | —     | 12           | 42.5  | +4.5* |
| 7A    | 38                               | —            | 39.2  | +1.2  | 13           | 40.0   | +2.0  | 14           | 45.4  | +7.4* | 12           | 45.0  | +7.0* |
| 7A    | 38                               | 44           | —     | —     | —            | —      | —     | 17           | 42.9  | +4.9* | —            | —     | —     |
| 7A    | 38                               | —            | 38.7  | +7    | —            | —      | —     | —            | —     | —     | —            | —     | —     |
| 8B    | 39                               | —            | —     | —     | 15           | 40.0   | +1.0  | —            | —     | —     | —            | —     | —     |
| 8A    | 39                               | { 45         | 35.4  | -2.6  | 14           | { 42.7 | +3.7  | 18           | 46.1  | +7.1* | —            | —     | —     |
| 8A    | 39                               | { 45         | 35.0  | -4.0* | —            | { 37.9 | -1.1  | —            | —     | —     | —            | —     | —     |
| 8A    | 39                               | { 46         | 38.1  | -1.3  | —            | —      | —     | —            | —     | —     | —            | —     | —     |
| 8A    | 39                               | { 46         | 37.7  | -2.0  | —            | —      | —     | —            | —     | —     | —            | —     | —     |
| 9     | 40                               | —            | 38.0  | -2.0  | —            | 39.1   | -.9   | —            | —     | —     | —            | —     | —     |
| 10    | 41                               | —            | 38.9  | -4.1  | —            | 42.4   | +1.4  | —            | —     | —     | —            | —     | —     |
| 11    | 42                               | —            | 38.1  | -3.9  | —            | 49.2   | +7.2* | —            | —     | —     | —            | —     | —     |
| 12    | 43                               | —            | 38.6  | -4.4* | —            | 41.8   | -1.2  | —            | —     | —     | —            | —     | —     |

All differences marked with a star (\*) are more than .1 the generalized city wide score.

TABLE VII  
HANDWRITING—COMPOSITION

| GRADE | GENERALIZED CITY SCORE | FROEDEL   |       |        | EMERSON   |       |       | JEFFERSON |       |       | BEVERIDGE |       |        |
|-------|------------------------|-----------|-------|--------|-----------|-------|-------|-----------|-------|-------|-----------|-------|--------|
|       |                        | Class No. | Score | Diff.  | Class No. | Score | Diff. | Class No. | Score | Diff. | Class No. | Score | Diff.  |
| 4C    | 31                     | 22        | 33.5  | +2.5   | —         | —     | —     | 9         | 32.8  | +1.8  | 8         | 27.0  | -4.0*  |
| 4C    | 32                     | 23        | 25.6  | +5.4*  | —         | —     | —     | 12        | 32.2  | -2    | 8         | 27.1  | -4.9*  |
| 4B    | 33                     | 24        | 33.0  | +1.0   | —         | —     | —     | 12        | 31.4  | +2    | 9         | 30.0  | -2.0   |
| 4A    | 34                     | 25        | 34.3  | +2.3   | 9         | 33.8  | +1.8  | 11        | 33.6  | +6    | 9         | 40.0  | +7.0*  |
| 5C    | 35                     | 26        | 33.7  | +2.7   | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 5C    | 36                     | 27        | 36.4  | +3.4*  | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 5C    | 37                     | 28        | 36.4  | +5.0*  | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 5B    | 38                     | 29        | 38.0  | -1.0   | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 5A    | 39                     | 30        | 33.0  | +2.5   | 11        | 37.5  | +2.5  | 10        | 40.0  | +6.0* | 10        | 29.0  | -5.0*  |
| 5A    | 40                     | 31        | 37.5  | +2.5   | —         | —     | —     | 15        | 39.1  | +4.1* | 10        | 32.0  | -3.0*  |
| 6C    | 41                     | 32        | —     | —      | —         | —     | —     | 13        | 32.3  | -2.7  | 11        | 45.0  | +9.0*  |
| 6B    | 42                     | 33        | 37.7  | +1.7   | —         | —     | —     | —         | 35.0  | -1.0  | 11        | 50.0  | +13.0* |
| 6B    | 43                     | 34        | 36.5  | +5.5   | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 6B    | 44                     | 35        | 37.5  | +2.7   | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 6A    | 45                     | 36        | 37.7  | +2.7   | 12        | 37.5  | +5    | —         | —     | —     | —         | —     | —      |
| 7C    | 46                     | 37        | —     | —      | —         | —     | —     | 17        | 36.3  | -1.7  | 11        | 36.6  | -4     |
| 7C    | 47                     | 38        | —     | —      | —         | —     | —     | 16        | 37.6  | -4    | 12        | 38.3  | +3     |
| 7B    | 48                     | 39        | —     | —      | 10        | 43.8  | +4.8* | —         | —     | —     | —         | —     | —      |
| 7A    | 49                     | 40        | 38.0  | -2.0   | 13        | 45.5  | +5.5* | 14        | 41.0  | +1.0  | 12        | 40.0  | +1.0   |
| 7A    | 50                     | 41        | 40.0  | —      | —         | —     | —     | 17        | 38.0  | -2.0  | 12        | 44.0  | +4.0*  |
| 8C    | 51                     | 42        | —     | —      | 15        | 35.8  | -6.2* | —         | —     | —     | —         | —     | —      |
| 8B    | 52                     | 43        | —     | —      | 14        | 45.0  | +1.0  | 18        | 40.0  | -4.0  | —         | —     | —      |
| 8A    | 53                     | 44        | 36.6  | -7.4*  | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 9     | 54                     | 45        | 43.3  | -6.3*  | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 10    | 55                     | 46        | 39.7  | -2.5   | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 11    | 56                     | 47        | 47.5  | +8.5*  | —         | —     | —     | —         | —     | —     | —         | —     | —      |
| 12    | 57                     | 48        | 42.5  | -8.5*  | —         | —     | —     | —         | —     | —     | —         | —     | —      |
|       | 58                     | 49        | 40.0  | -11.0* | —         | —     | —     | —         | —     | —     | —         | —     | —      |

\*All differences marked with a star (\*) are more than .1 the generalized score.

## IV. MISPELLING IN EIGHTH GRADE COMPOSITIONS

## LIST OF WORDS MISPELLED, EXCLUDING SLIPS AND ILLEGIBLE WORDS

Words double starred were found misspelled in the fourth grade compositions

|    | WORDS       | TIMES<br>USED | TIMES<br>MIS-<br>SPELLED | GRADE<br>BY<br>JONES |    | WORDS       | TIMES<br>USED | TIMES<br>MIS-<br>SPELLED | GRADE<br>BY<br>JONES |
|----|-------------|---------------|--------------------------|----------------------|----|-------------|---------------|--------------------------|----------------------|
| 1  | above       | 8             | 1                        | 2nd                  | 46 | burros      | 2             | 2                        | NL                   |
| 2  | accident    | 22            | 1                        | 7th**                | 47 | butterflies | 2             | 1                        | 2nd**                |
| 3  | across      | 24            | 4                        | 2nd**                | 48 | cabin       | 13            | 3                        | 4th                  |
| 4  | afraid      | 15            | 1                        | 2nd**                | 49 | Calumet     | 3             | 1                        | NLD**                |
| 5  | after       | 94            | 1                        | 2nd**                | 50 | capital     | 3             | 2                        | 4th                  |
| 6  | again       | 30            | 1                        | 2nd**                | 51 | carbon      | 7             | 1                        | NL                   |
| 7  | Albuquerque | 1             | 1                        | NLD                  | 52 | carriage    | 1             | 1                        | 4th**                |
| 8  | all right   | 32            | 4                        | 2nd**                | 53 | carry       | 4             | 1                        | 2nd**                |
| 9  | almost      | 12            | 1                        | 3rd**                | 54 | caught      | 18            | 1                        | 2nd**                |
| 10 | amuse       | 1             | 1                        | 5th                  | 55 | changed     | 2             | 1                        | 2nd**                |
| 11 | animals     | 3             | 2                        | 4th                  | 56 | Charlie     | 1             | 1                        | NLD                  |
| 12 | apart       | 1             | 1                        | NL                   | 57 | chase       | 4             | 1                        | 2nd**                |
| 13 | apiece      | 2             | 1                        | NL                   | 58 | child       | 4             | 1                        | 2nd                  |
| 14 | apparently  | 1             | 1                        | 7th                  | 59 | chocolate   | 2             | 2                        | 4th**                |

# APPENDIX A

407

|    |             |    |       |    |                |    |   |       |
|----|-------------|----|-------|----|----------------|----|---|-------|
| 15 | appearance  | 1  | 8th   | 60 | cigarette      | 1  | 1 | 2nd   |
| 16 | around      | 43 | 2nd** | 61 | circus         | 10 | 2 | 2nd** |
| 17 | arrangement | 1  | 8th   | 62 | climbed        | 5  | 2 | 2nd** |
| 18 | attract     | 2  | NL    | 63 | closely        | 1  | 1 | 2nd*  |
| 19 | auditorium  | 3  | NL    | 64 | clouds         | 5  | 2 | 2nd*  |
| 20 | aunt        | 12 | 2nd** | 65 | collide        | 1  | 1 | NL    |
| 21 | automobile  | 10 | 2nd** | 66 | coming         | 40 | 3 | 2nd** |
| 22 | awfully     | 1  | 4th*  | 67 | continued      | 2  | 1 | 6th   |
| 23 | balloons    | 1  | 2nd   | 68 | couldn't       | 12 | 1 | 2nd** |
| 24 | bashful     | 1  | 2nd   | 69 | court          | 1  | 1 | 6th   |
| 25 | because     | 48 | 2nd** | 70 | covered        | 4  | 1 | 2nd   |
| 26 | beetles     | 1  | NL    | 71 | cow-puncher    | 2  | 1 | NL    |
| 27 | before      | 41 | 2nd** | 72 | crash          | 4  | 1 | NL    |
| 28 | beginning   | 3  | 2nd   | 73 | cupboard       | 1  | 1 | 2nd   |
| 29 | believe     | 3  | 2nd** | 74 | cushions       | 1  | 1 | 6th   |
| 30 | berth       | 2  | 7th** | 75 | decided        | 17 | 3 | 6th   |
| 31 | bicycle     | 4  | 2nd** | 76 | deep           | 14 | 1 | 2nd   |
| 32 | biggest     | 1  | 2nd** | 77 | demonstrations | 1  | 1 | NL    |
| 33 | blizzard    | 1  | 3rd   | 78 | deal           | 1  | 1 | 7th   |
| 34 | boarded     | 2  | 2nd*  | 79 | didn't         | 28 | 1 | 2nd** |
| 35 | boat        | 68 | 2nd** | 80 | different      | 20 | 2 | 2nd** |
| 36 | bouillon    | 1  | NL    | 81 | disappointment | 2  | 2 | 8th   |
| 37 | bouquet     | 2  | 4th   | 82 | discovered     | 1  | 1 | 4th*  |
| 38 | bracelet    | 5  | NL    | 83 | dismissed      | 2  | 1 | 4th*  |
| 39 | bruises     | 1  | 2nd   | 84 | drowned        | 3  | 1 | 2nd** |
| 40 | bucketful   | 1  | NL    | 85 | drowning       | 6  | 1 | 2nd*  |
| 41 | buggy       | 1  | 2nd** | 86 | earlier        | 1  | 1 | 2nd   |
| 42 | building    | 5  | 2nd   | 87 | empty          | 1  | 1 | 2nd   |
| 43 | built       | 6  | 2nd** | 88 | engineer       | 4  | 1 | 6th   |
| 44 | bundled     | 1  | 3rd   | 89 | enjoying       | 3  | 1 | 4th   |
| 45 | burro       | 2  | NL    | 90 | escape         | 1  | 1 | 4th   |

## APPENDIX A

MISSPELLINGS (Continued)

|     | WORDS       | TIMES<br>USED | TIMES<br>MIS-<br>SPELLED | GRADE<br>BY<br>JONES |     | WORDS        | TIMES<br>USED | TIMES<br>MIS-<br>SPELLED | GRADE<br>BY<br>JONES |
|-----|-------------|---------------|--------------------------|----------------------|-----|--------------|---------------|--------------------------|----------------------|
| 91  | especially  | 1             | 1                        | 5th                  | 146 | horses       | 22            | 1                        | 2nd**                |
| 92  | everything  | 10            | 1                        | NL                   | 147 | hospital     | 1             | 1                        | 5th**                |
| 93  | excitement  | 4             | 1                        | 7th                  | 148 | hours        | 7             | 1                        | 2nd**                |
| 94  | exciting    | 76            | 6                        | 7th**                | 149 | high         | 12            | 2                        | 2nd**                |
| 95  | exhausted   | 2             | 1                        | 8th*                 | 150 | hungry       | 8             | 1                        | 2nd                  |
| 96  | experience  | 68            | 14                       | 7th**                | 151 | hurricane    | 1             | 1                        | 4th                  |
| 97  | experiment  | 2             | 1                        | NL                   | 152 | iceberg      | 4             | 1                        | NL                   |
| 98  | familiar    | 1             | 1                        | 8th                  | 153 | immediately  | 7             | 4                        | 7th                  |
| 99  | far         | 39            | 1                        | 2nd                  | 154 | immense      | 1             | 1                        | 7th                  |
| 100 | farthest    | 1             | 1                        | 2nd                  | 155 | impossible   | 2             | 1                        | 7th                  |
| 101 | father      | 55            | 1                        | 2nd**                | 156 | Independence | 3             | 8                        | NLD                  |
| 102 | fell        | 27            | 1                        | 2nd**                | 157 | Indian       | 4             | 1                        | 2nd                  |
| 103 | felt        | 7             | 1                        | 2nd                  | 158 | Indiana      | 6             | 1                        | NLD                  |
| 104 | field       | 2             | 1                        | 2nd**                | 159 | interested   | 1             | 1                        | 5th*                 |
| 105 | finally     | 18            | 6                        | 3rd**                | 160 | interesting  | 11            | 2                        | 5th**                |
| 106 | fixed       | 8             | 1                        | 2nd**                | 161 | Ivy          | 1             | 1                        | NLD                  |
| 107 | for         | 206           | 2                        | 2nd**                | 162 | janitor      | 2             | 1                        | NL                   |
| 108 | forgot      | 8             | 1                        | 2nd                  | 163 | jeweler      | 3             | 8                        | NL                   |
| 109 | forgotten   | 3             | 1                        | 2nd**                | 164 | jewelry      | 2             | 2                        | 8th                  |
| 110 | fortunate   | 1             | 1                        | 7th                  | 165 | Joliet       | 3             | 1                        | NLD                  |
| 111 | fortunately | 1             | 1                        | 7th*                 | 166 | jolly        | 1             | 1                        | 4th                  |
| 112 | found       | 85            | 1                        | 2nd**                | 167 | jumped       | 18            | 2                        | 2nd**                |
| 113 | friend      | 18            | 1                        | 2nd**                | 168 | kindergarten | 1             | 1                        | NL**                 |
| 114 | frightened  | 16            | 3                        | 4th**                | 169 | knew         | 19            | 2                        | 2nd**                |

# APPENDIX A

489

|     |            |     |              |   |    |       |
|-----|------------|-----|--------------|---|----|-------|
| 115 | Fröbel     | 170 | knives       | 1 | 1  | 2nd   |
| 116 | from       | 171 | knock        | 1 | 1  | 2nd** |
| 117 | front      | 172 | knocked      | 3 | 10 | 2nd** |
| 118 | funny      | 173 | knocking     | 1 | 1  | 2nd** |
| 119 | further    | 174 | lock         | 1 | 1  | 2nd** |
| 120 | fuses      | 175 | lain         | 1 | 2  | 6th   |
| 121 | gave       | 176 | large        | 1 | 81 | 2nd   |
| 122 | ghosts     | 177 | LaSalle      | 1 | 1  | NLD   |
| 123 | glittering | 178 | later        | 1 | 14 | 3rd   |
| 124 | glorious   | 179 | laughed      | 1 | 1  | 2nd   |
| 125 | got        | 180 | least        | 1 | 1  | 5th   |
| 126 | grabbed    | 181 | leaves       | 1 | 6  | 2nd** |
| 127 | grandpa    | 182 | lessons      | 1 | 2  | NL    |
| 128 | gravel     | 183 | let          | 1 | 17 | 2nd   |
| 129 | gym        | 184 | lift         | 3 | 2  | 2nd   |
| 130 | hammock    | 185 | light        | 1 | 5  | 2nd** |
| 131 | happened   | 186 | lightning    | 1 | 1  | 2nd** |
| 132 | happening  | 187 | lightning    | 1 | 9  | 2nd** |
| 133 | Harold     | 188 | little       | 4 | 83 | 2nd** |
| 134 | has        | 189 | locker       | 2 | 2  | NL    |
| 135 | hastily    | 190 | losing       | 1 | 1  | 3rd   |
| 136 | heard      | 191 | lying        | 1 | 4  | 3rd   |
| 137 | hide       | 192 | mamma        | 1 | 1  | 2nd   |
| 138 | hitting    | 193 | many         | 1 | 47 | 2nd** |
| 139 | hold       | 194 | man's        | 1 | 1  | 2nd   |
| 140 | holloed    | 195 | marshmallows | 1 | 1  | NL    |
| 141 | hollow     | 196 | merry        | 1 | 2  | 4th   |
| 142 | home       | 197 | Milwaukee    | 1 | 4  | NLD   |
| 143 | book       | 198 | Minnesota    | 4 | 2  | NLD   |
| 144 | hooked     | 199 | minute       | 2 | 7  | 2nd** |
| 145 | horse      | 200 | minutes      | 1 | 14 | 2nd** |

## APPENDIX A

## MISSPELLINGS (Continued)

|     | WORDS       | TIMES<br>USED | TIMES<br>MIS-<br>SPELLED | GRADE<br>BY<br>JONES |     | WORDS       | TIMES<br>USED | TIMES<br>MIS-<br>SPELLED | GRADE<br>BY<br>JONES |
|-----|-------------|---------------|--------------------------|----------------------|-----|-------------|---------------|--------------------------|----------------------|
| 201 | money       | 4             | 1                        | 2nd**                | 256 | really      | 2             | 1                        | 5th                  |
| 202 | month       | 11            | 2                        | 2nd**                | 257 | remember    | 6             | 1                        | 2nd**                |
| 203 | motor       | 8             | 1                        | 2nd**                | 258 | resemblance | 1             | 1                        | NL                   |
| 204 | mountain    | 6             | 3                        | 4th                  | 259 | resorts     | 1             | 1                        | 8th                  |
| 205 | mountains   | 20            | 1                        | 2nd**                | 260 | restaurant  | 1             | 1                        | 3rd                  |
| 206 | much        | 37            | 1                        | 2nd**                | 261 | restless    | 1             | 1                        | 8th                  |
| 207 | museum      | 5             | 4                        | 7th                  | 262 | rickety     | 1             | 1                        | NL                   |
| 208 | my          | 238           | 1                        | 2nd**                | 263 | riding      | 10            | 1                        | NL                   |
| 209 | neighboring | 2             | 1                        | 2nd*                 | 264 | road        | 29            | 1                        | 2nd**                |
| 210 | no          | 21            | 2                        | 2nd**                | 265 | row         | 4             | 1                        | 2nd**                |
| 211 | northern    | 8             | 1                        | NL                   | 266 | rowing      | 3             | 2                        | 2nd**                |
| 212 | occurred    | 6             | 3                        | 2nd*                 | 267 | running     | 25            | 3                        | 2nd*                 |
| 213 | o'clock     | 37            | 3                        | 2nd**                | 268 | safety      | 7             | 4                        | 2nd**                |
| 214 | off         | 45            | 6                        | 2nd**                | 269 | safo        | 1             | 1                        | 4th                  |
| 215 | omitting    | 1             | 1                        | 6th                  | 270 | saloon      | 2             | 2                        | NL**                 |
| 216 | opened      | 4             | 1                        | 2nd**                | 271 | Saturday    | 4             | 1                        | 2nd**                |
| 217 | opening     | 1             | 1                        | 2nd*                 | 272 | scared      | 10            | 1                        | 2nd**                |
| 218 | opossum     | 1             | 1                        | NL                   | 273 | scary       | 1             | 1                        | 2nd*                 |
| 219 | originated  | 1             | 1                        | NL                   | 274 | scene       | 3             | 1                        | 5th                  |
| 220 | Orpheum     | 1             | 1                        | NLD                  | 275 | scratch     | 2             | 1                        | 2nd                  |
| 221 | other       | 52            | 1                        | 2nd**                | 276 | screaming   | 1             | 1                        | 3rd                  |
| 222 | our         | 107           | 2                        | 2nd**                | 277 | sea-gulls   | 1             | 1                        | NL                   |
| 223 | ourselves   | 7             | 1                        | 4th**                | 278 | seem        | 4             | 1                        | 4th**                |
| 224 | over        | 64            | 1                        | 2nd**                | 279 | seat        | 7             | 1                        | 2nd                  |

# APPENDIX A

411

|     |                |    |   |       |     |             |     |   |       |
|-----|----------------|----|---|-------|-----|-------------|-----|---|-------|
| 225 | owned          | 2  | 1 | 2nd** | 280 | seemed      | 12  | 1 | 4th** |
| 226 | paddler        | 2  | 2 | 2nd   | 281 | selves      | 1   | 1 | NL    |
| 227 | padding        | 2  | 2 | 2nd   | 282 | senseless   | 2   | 1 | NL    |
| 228 | parents        | 1  | 1 | 4th   | 283 | September   | 1   | 1 | 4th   |
| 229 | passed         | 9  | 2 | 2nd   | 284 | several     | 4   | 1 | 6th   |
| 230 | passenger      | 2  | 1 | 3rd   | 285 | she         | 108 | 1 | 2nd** |
| 231 | past           | 12 | 1 | 7th   | 286 | Shetland    | 1   | 1 | NLD   |
| 232 | patent-leather | 1  | 1 | NL    | 287 | shining     | 4   | 1 | 2nd** |
| 233 | Pennsylvania   | 6  | 1 | NLD** | 288 | shrieking   | 1   | 1 | 6th*  |
| 234 | period         | 4  | 1 | 2nd   | 289 | shouting    | 1   | 1 | 6th*  |
| 235 | permit         | 1  | 1 | 7th   | 290 | sister      | 18  | 1 | 2nd** |
| 236 | Phoenix        | 1  | 1 | NLD   | 291 | situated    | 1   | 1 | NL    |
| 237 | piece          | 3  | 2 | 2nd** | 292 | size        | 2   | 1 | 4th   |
| 238 | pill           | 1  | 1 | NL    | 293 | sled        | 8   | 1 | 2nd** |
| 239 | pitch-dark     | 1  | 1 | NL    | 294 | slept       | 7   | 3 | 2nd** |
| 240 | planned        | 2  | 2 | 5th*  | 295 | slipped     | 4   | 1 | 2nd** |
| 241 | planning       | 1  | 1 | 6th   | 296 | slippery    | 2   | 1 | 2nd** |
| 242 | policeman      | 8  | 1 | NL**  | 297 | smashed     | 1   | 1 | NL    |
| 243 | porches        | 2  | 1 | 2nd   | 298 | smoking     | 2   | 1 | 2nd   |
| 244 | pretty         | 16 | 8 | 2nd** | 299 | snakes      | 17  | 2 | 2nd** |
| 245 | promenaded     | 1  | 1 | NL    | 300 | something   | 3   | 2 | 2nd** |
| 246 | pulled         | 17 | 1 | 2nd** | 301 | soon        | 43  | 2 | 2nd** |
| 247 | put            | 28 | 2 | 2nd** | 302 | sound       | 12  | 3 | 2nd   |
| 248 | putting        | 3  | 1 | 2nd   | 303 | spend       | 2   | 1 | 2nd   |
| 249 | quarter        | 2  | 1 | NL    | 304 | splendid    | 2   | 2 | 6th   |
| 250 | quite          | 24 | 2 | 3rd** | 305 | Springfield | 1   | 1 | NLD   |
| 251 | quieted        | 2  | 1 | 3rd   | 306 | spring      | 1   | 1 | 2nd   |
| 252 | rabbits        | 4  | 1 | 2nd** | 307 | started     | 114 | 5 | 2nd** |
| 253 | ran            | 63 | 1 | 2nd** | 308 | starvation  | 1   | 1 | NL    |
| 254 | reach          | 7  | 1 | 2nd   | 309 | stay        | 11  | 1 | 2nd** |
| 255 | reached        | 18 | 1 | 2nd   | 310 | steer       | 7   | 1 | 2nd   |



## APPENDIX A

MISPELLINGS (Continued)

|     | WORDS         | TIMES<br>USED | TIMES<br>MIS-<br>SPELLED | GRADE<br>BY<br>JONES |     | WORDS    | TIMES<br>USED | TIMES<br>MIS-<br>SPELLED | GRADE<br>BY<br>JONES |
|-----|---------------|---------------|--------------------------|----------------------|-----|----------|---------------|--------------------------|----------------------|
| 311 | stepped       | 3             | 1                        | 2nd**                | 356 | wabbled  | 1             | 1                        | 3rd*                 |
| 312 | stopped       | 39            | 7                        | 2nd**                | 357 | wait     | 7             | 1                        | 2nd                  |
| 313 | storm         | 55            | 1                        | 2nd**                | 358 | waited   | 8             | 1                        | 2nd*                 |
| 314 | St. Patrick's | 1             | 1                        | NL**                 | 359 | walking  | 8             | 1                        | 2nd                  |
| 315 | straight      | 3             | 1                        | NLD                  | 360 | wanted   | 26            | 2                        | 2nd**                |
| 316 | strike        | 2             | 1                        | 2nd                  | 361 | watch    | 8             | 1                        | 2nd                  |
| 317 | stripped      | 1             | 1                        | 2nd                  | 362 | water    | 58            | 1                        | 2nd**                |
| 318 | suggested     | 3             | 1                        | 5th                  | 363 | we       | 891           | 1                        | 2nd**                |
| 319 | Sunday        | 7             | 3                        | 8th*                 | 364 | weighed  | 1             | 1                        | 2nd**                |
| 320 | supper        | 11            | 2                        | 2nd**                | 365 | went     | 242           | 6                        | 2nd**                |
| 321 | swimming      | 17            | 1                        | 2nd**                | 366 | wheeler  | 1             | 1                        | 6th*                 |
| 322 | talking       | 8             | 1                        | 2nd**                | 367 | where    | 45            | 7                        | 2nd**                |
| 323 | telephone     | 2             | 1                        | 2nd**                | 368 | whether  | 2             | 1                        | 2nd**                |
| 324 | ten           | 16            | 1                        | 2nd                  | 369 | which    | 85            | 1                        | 2nd**                |
| 325 | terrible      | 2             | 1                        | 6th**                | 370 | while    | 65            | 1                        | 2nd**                |
| 326 | than          | 16            | 3                        | 2nd**                | 371 | worrying | 1             | 1                        | 4th*                 |
| 327 | that          | 33            | 1                        | 2nd**                | 372 | wouldn't | 4             | 1                        | 2nd                  |
| 328 | their         | 25            | 5                        | 2nd**                | 373 | worst    | 3             | 1                        | 2nd**                |
| 329 | them          | 39            | 2                        | 2nd**                | 374 | wrapped  | 1             | 1                        | 2nd**                |
| 330 | then          | 188           | 2                        | 2nd**                | 375 | writing  | 1             | 1                        | 2nd                  |
| 331 | there         | 145           | 9                        | 2nd**                | 376 | X-ray    | 1             | 1                        | NL                   |
| 332 | they          | 60            | 1                        | 2nd**                |     |          |               |                          |                      |
| 333 | thought       | 7             | 4                        | 2nd**                |     |          |               |                          |                      |
| 334 | threw         |               | 2                        | 2nd**                |     |          |               |                          |                      |

# APPENDIX A

413

|     |               |     |    |       |
|-----|---------------|-----|----|-------|
| 335 | through       | 49  | 4  | 2nd** |
| 336 | tie           | 1   | 1  | 2nd   |
| 337 | tied          | 1   | 1  | 2nd** |
| 338 | ties          | 1   | 1  | 2nd*  |
| 339 | tipped        | 3   | 1  | 2nd   |
| 340 | told          | 51  | 1  | 2nd** |
| 341 | too           | 14  | 10 | 2nd** |
| 342 | towards       | 5   | 1  | 2nd   |
| 343 | towels        | 1   | 1  | 2nd   |
| 344 | tried         | 17  | 1  | 2nd** |
| 345 | trouble       | 1   | 1  | 4th   |
| 346 | tug           | 1   | 1  | NL    |
| 347 | turtles       | 1   | 1  | 3rd   |
| 348 | two           | 53  | 2  | 2nd** |
| 349 | unconscious   | 4   | 2  | 6th   |
| 350 | unfortunately | 1   | 1  | 8th*  |
| 351 | us            | 113 | 1  | 2nd** |
| 352 | usually       | 3   | 2  | 7th   |
| 353 | viewing       | 1   | 1  | 4th*  |
| 354 | village       | 2   | 2  | 4th   |
| 355 | visitor       | 1   | 1  | 3rd   |

NLD means not listed—discarded. This class of words includes all proper names and prepositions.

NL means not listed in Jones.

• means that the word is some simple derivative of a word used in Jones list.

NOTE: It is probable that 7 misspellings of very simple words as "us," "we," "my," etc., to be found in this table should have been included in slips.

Total number of different words misspelled by eighth grade children and found also among those misspelled by the fourth grade — 138, or 42 per cent. of the total of words misspelled by the eighth grade.

## APPENDIX A

USE AND MISPELLINGS IN THE GARY EIGHTH GRADE COMPOSITIONS OF THE SO-CALLED "HUNDRED SPELLING  
DEMONS"

Also Average Accuracy of Spelling of the Same Words by Eighth Grade Children According to Ayres' Spelling  
Scale

| NO. | WORD  | TIMES<br>USED | TIMES<br>MIS-<br>SPELLLED | AYRES<br>VALUE | NO. | WORD  | TIMES<br>USED | TIMES<br>MIS-<br>SPELLLED | AYRES<br>VALUE | NO. | WORD   | TIMES<br>USED | TIMES<br>MIS-<br>SPELLLED | AYRES<br>VALUE |
|-----|-------|---------------|---------------------------|----------------|-----|-------|---------------|---------------------------|----------------|-----|--------|---------------|---------------------------|----------------|
| 1   | any   | 23            |                           | 100            | 34  | they  | 149           | 1                         | 100            | 67  | which  | 85            | 1                         | 98             |
| 2   | buy   | 2             |                           | 100            | 35  | used  | 9             |                           | 100            | 68  | whole  | 1             |                           | 99             |
| 3   | too   | 14            | 10                        | 92             | 36  | very  | 129           |                           | 100            | 69  | women  | 4             |                           | 96             |
| 4   | two   | 53            | 2                         | 100            | 37  | near  | 1             |                           | 94             | 70  | would  | 106           |                           | 100            |
| 5   | ache  | 0             |                           | —              | 38  | week  | 6             |                           | 100            | 71  | write  | 2             |                           | 100            |
| 6   | been  | 39            |                           | 100            | 39  | won't | 1             |                           | —              | 72  | wrote  | 0             |                           | 100            |
| 7   | blue  | 2             |                           | 100            | 40  | again | 30            | 1                         | 100            | 73  | always | 10            |                           | 100            |
| 8   | busy  | 0             |                           | 94             | 41  | among | 1             |                           | 100            | 74  | answer | 7             |                           | 98             |
| 9   | can't | 1             |                           | —              | 42  | break | 2             |                           | —              | 75  | choose | 0             |                           | —              |
| 10  | dear  | 1             |                           | 100            | 43  | built | 6             | 2                         | 100            | 76  | coming | 40            | 3                         | 100            |
| 11  | does  | 3             |                           | 98             | 44  | color | 4             |                           | —              | 77  | doctor | 21            |                           | 100            |
| 12  | done  | 10            |                           | 100            | 45  | cough | 0             |                           | —              | 78  | enough | 8             |                           | 99             |
| 13  | don't | 4             |                           | 99             | 46  | could | 96            |                           | 100            | 79  | friend | 18            | 1                         | 99             |
| 14  | easy  | 0             |                           | 100            | 47  | early | 7             |                           | 100            | 80  | having | 11            |                           | —              |
| 15  | half  | 34            |                           | 100            | 48  | every | 11            |                           | 100            | 81  | hoarse | 0             |                           | —              |

# APPENDIX A

415

|    |      |    |     |    |       |     |     |     |           |    |   |     |
|----|------|----|-----|----|-------|-----|-----|-----|-----------|----|---|-----|
| 16 | hear | 10 | 100 | 49 | forty | 2   | 99  | 82  | making    | 7  | 1 | 88  |
| 17 | here | 11 | 100 | 50 | guess | 0   | 84  | 83  | minute    | 7  |   | 98  |
| 18 | hour | 33 | 100 | 51 | heard | 36  | 100 | 84  | though    | 6  | 1 | 92  |
| 19 | just | 59 | 100 | 52 | loose | 1   | —   | 85  | believe   | 3  | 2 | 84  |
| 20 | knew | 19 | 99  | 53 | meant | 0   | 84  | 86  | beginning | 3  |   |     |
| 21 | know | 19 | 100 | 54 | often | 2   | 92  | 87  | business  | 0  |   | 88  |
| 22 | laid | 2  | —   | 55 | piece | 3   | 92  | 88  | country   | 15 |   | 100 |
| 23 | lose | 0  | 92  | 56 | raise | 1   | 99  | 89  | February  | 0  |   | 73  |
| 24 | many | 47 | 100 | 57 | ready | 3   | 100 | 90  | grammar   | 0  |   | —   |
| 25 | much | 37 | 100 | 58 | seems | 4   | 100 | 91  | instead   | 5  |   | 99  |
| 26 | none | 2  | 99  | 59 | shoes | 3   | —   | 92  | separate  | 0  |   | 73  |
| 27 | once | 25 | 100 | 60 | since | 3   | 98  | 93  | straight  | 3  | 1 | —   |
| 28 | read | 2  | 100 | 61 | sugar | 0   | —   | 94  | through   | 49 | 4 | 100 |
| 29 | said | 51 | 100 | 62 | their | 25  | 96  | 95  | tonight   | 3  |   | 100 |
| 30 | says | 15 | 100 | 63 | there | 145 | 100 | 96  | trouble   | 1  | 1 | 98  |
| 31 | some | 85 | 100 | 64 | tired | 8   | 100 | 97  | Tuesday   | 0  |   | 99  |
| 32 | sure | 8  | 100 | 65 | truly | 0   | 99  | 98  | Wednesday | 0  |   | 88  |
| 33 | tear | 0  | —   | 66 | where | 45  | 100 | 99  | whether   | 2  | 1 | 84  |
|    |      |    |     |    |       |     |     | 100 | writing   | 1  |   | —   |

The table is to be read as follows: The word "any," called by Jones a "spelling demon," was used by not more than 23 out of 127 eighth grade children in their compositions. It was not misspelled. According to Ayres, the average accuracy of spelling of this word by eighth grade children is 100 per cent. The table shows that the so-called "demons" are really very simple words, and that as the difficulty of the words increases, they were used by fewer children at Cary and more often misspelled.

## V. SAMPLE GARY COMPOSITIONS ARRANGED AS A SCALE

The samples below constitute a composition scale and are given that the reader may see the nature of such a scale when all samples are of one general type. In the Hillegas Scale the samples vary greatly in style and content and the effect of this added complexity is to confuse the judgment of those who have no conception of the general scheme of development in composition. On the other hand, the exact value of the samples in the Hillegas Scale has been determined with great care, so that it is much better to base judgment directly upon the Hillegas Scale, provided the person who does the scoring uses the scale only as a means of deciding the exact value a given composition should receive.

Papers which range in value from 0 to 30 units have a common characteristic, they are difficult to read and understand. The errors in spelling and syntax are so many and so gross that on first reading the words "do not make sense." One must read and reread many times before the meaning is apparent. Sometimes even then one is not sure what the writer of the composition really intended to say.

The exact value to be assigned such samples will be

determined by the degree to which the meaning can be made out. If no meaning is apparent after study, the paper would, of course, have zero value, but such samples will be found but rarely. Sample A is an illustration of a composition in which the errors are so many and so gross that little meaning is apparent.

## SAMPLE A

## AN EXCITING EXPERIENCE

I was on a wonderful to now-Yeark and it waos  
and the journey that I lecekt so mouch butit  
the fun I head on the trean but the buge ried in  
ealmer Nou-Yeaork waos the beast thean. and  
I belavef is all that I can thank on so godboy.

Here and there it is possible to get a glimpse of the thought the child was trying to express, and there is a certain persistence of general subject throughout the composition as a whole. Its value, therefore, will be somewhere between 0 and 9. The value assigned by the Gary judges was 5 (average deviation of two judgments 5).

Sample B represents a higher stage of development.

## SAMPLE B

## THE BEAER AND A BOY

Ones their wasa littil boy. Hewen went in the  
weth a gan and a hachet and he he saw a beaer.

The beaer begain to run after the boy. And their was a oke tree he stared to clamb the tree. The beaer avas after the boy and the beaer stared to clamb the tree. And the beaer clambed and clambd so the boy thart he beter get out of their he fawed a hol in the so the got down in the hol and the beaer con't find the boy. So the beaer went on an lime. The bay clambd out and chot the lime of and the bearer was celed.

There is continuity of thought, and although the errors are so many and so gross that it is necessary to read and reread the words before one can translate them into their conventional form, still it is possible to make out the general meaning. Such a composition will range in value from 10 to 19. The value assigned this composition by the Gary judges was 15 (average deviation of two judgments 5).

Sample C represents a still higher stage of development.

#### SAMPLE C

Once My nother want to voiter a frinced And she take me a gave me to my aunt thats ny mother want away And my aunt was chopping wood AndI was playing biut a bucter Came and ny aent want inside The house and I want and take The hatck and was chopping the wood

with the hatchek and chop my Finger and my  
nother wasnot Home so I uat crying and Than  
ny mother came after There day and I was over  
ny aunt House I was in bed and ny mother was  
glad I was Well and I was happy again And than  
I have a mark on My frienger it is the left hand  
Frienger it is the 2ndfrineger and the Than  
after my mother take me Home and I was a  
happy girl After But I was till or ny frienger  
That marke stayed ny mother Was helfing my  
friend and Now I am happy girl as Happy as  
can be happy.

There are enough words correctly spelled and correctly arranged in the conventional sequence so that one can get, even on a single reading, the general drift of the meaning. However, even in this paper one must read and reread parts of it before he is sure what thought the writer intended to express. Papers of this character range in value from 20 to 29. The value assigned this paper by the Gary judges was 20 (average deviation of two judgments 0).

In passing from samples of the first type to samples of the second type the emphasis shifts from gross errors in spelling and structure to errors in organization. The general characteristic of samples of this type is that they are tiresome to read.

The worst sample of the second type consists of mere succession of sentences loosely joined. Sample D is an



illustration and the value of such composition ranges from 30 to 39 Hillegas.

## SAMPLE D

## IN THE MOUNTAINS

As we went to spent our vacation I happen to be right near the mountains I was glad cause I could go and climb just as high as I want for.

So I went with my father and mother we went pvery hiegh it was getting cold already why I think abouve the clouds I want to rich the tops but couldn cause there was ice and it was so sleapry to goe any further se we came baak when we came down there was many more mountains and I disided to go on some others well & ni went it wasnot very hiegh just like others so when nex were clinbing it little to sandy we riched the top alright but whenwe wanted to come down why we couldn mole so we sat down and slide down in that way we couldn get down in that city where we were its too cold in summer sometimes its snowing but this little city was full of trees and mountains.

Note the frequent use of the word "and" joining disconnected thoughts, also the amount of irrelevant material. The value of the sample is determined by the general effect produced by disorganization and the

mechanical mistakes. The value assigned this composition by the Gary judges was 30 (median deviation of five judgments 2, average deviation 3.6).

In Sample E the gross errors are much less in number and less serious in character. On the other hand, the amount of irrelevant material is large.

#### SAMPLE E

##### AN EXCITING EXPERIENCE

One day it was very hot and we didn't know what do do.

This was at our Gym. period, so we went over on the lawn and sat under a tree for a while in the shade.

After a while one of the girls said, Let's play something." We all suggested that we would play ghost. We started and played for a long while and then we got tired and we sugested we would play something else so we played leap frog.

We were awfully hot now so we sat down in the shade and rested ourselves.

After a while one of the girls sugested that we would play statue. We had been playing awhile and it was my turn to be be swung around. The girl that was swinging had swung all the other girls and they were pretty heavy then she took me and swung me around fast not thinking

of how light I was she let me go and I fell on my left wrist. I heard it crack and I thought it was broke, they took me down in the Gym and the Gym teacher bandaged it up. It was not broke, but it was sprained.

I bet there were fifty girls that asked me where I fell what I was doing an how it was done. Well that was the last game that I have played since then.

The value assigned this composition by the Gary judges was 40 (median deviation of five judgments 0, average deviation 1).

Sample F represents a still higher degree of ability.

#### SAMPLE F

##### AN ACCIDENT

We were out at camp No 133 which is situated ~~in-on~~ near the banks of Deep River. One of the men that stayed at this camp owned a old duck boat which leaked and if you wanted to ride in it you would have to set a certain way ot it would fill with water and soon sink.

My brother saw me paddaling around in it and he decided that he would do it himself.

He weighed about twenty-five lbs. more than me I told him the way to set in it but he would

not listen but said that one end was as good as the other.

He jumped in and sat down on the nearest end which was the wrong end and paddled out into the river. He paddled down the river for some distance and then turned around to come back. By this time the boat was nearly sinking and we saw him paddling as fast as he could go to get back to the bank.

But it was of no use the boat began to sink and he tried to get to the right end but in trying to get to the right end he upset the boat and had to swim with all of his clothes on. The water wasn't very cold and he swam all the way to up the bridge pushing the boat with him. He soon was in dry clothes and was none the worse for the accident.

The composition deals with a single incident and there are evidences of organization and intelligent selection of material. On the other hand, the errors in spelling and structure are sufficient in number and character to mar the continuity of thought, and the composition as a whole, like others of this type, is tiresome to read. The value assigned this composition by the Gary judges was 50 (median deviation of five judgments 0, average deviation .2).

Sample G represents the best sample of this type.

## SAMPLE G

## ON THE WATER

While at a small lake not far from Gary my small brother had quite an exciting adventure. The lake is quite deep and though my brother can row a boat quite well we never allowed him to go out in a boat by himself .

One day my brother asked mother if he might go down to the beach. She replied, "Yes, but do not get into the boats." Clouds began to gather and it looked as though we would have a violent electric storm.

It began to get dark and mother thought of Bud so she sent my sister to get him. After a few minutes she came back saying that Bud was not on the beach.

We asked if any one had seen him but no one had. I thought that he might be playing with one of the little boys so I went to a house on the bluff expecting to find him there.

While I was on the porch, which over looks the lake, it began to thunder & lighten & soon the rain came down in torrents. I stood looking out over the lake & and I noticed a boat sway at the other side of the lake.

I ran to my father and told him what I had seen. He hurried to the beach & found that

one of the boats was missing. Then he and my sister took a boat and in about twenty minutes they came back with a rather frightened & very much bedraggled little boy.

He, my brother, showed great presence of mind, for when the storm began he was not frightened very much and tried to reach the shore.

You may be sure that he did not dare to go out in a boat alone after that. He told us that he would learn to swim first.

In content, in organization, and in choice of words, this composition gives evidence of considerable power. The errors, however, are enough to spoil the effect of the composition as a whole, and to read many such papers would be a tiresome task. The value assigned this composition by the Gary judges was 60 (median deviation of five judgments 8, average deviation 6.6).

In the samples in the third division the literary appeal of the composition is its chief characteristic. Errors in mechanics and in organization there may be, but the choice of subject matter and the selection of words to express the writer's thoughts are so skillful that the appeal of the story is great enough to hold the reader's interest and attention in spite of such defects.

Sample H, for instance, was given a value of 67 by the Gary judges (median deviation of five judgments 1, average deviation 4).

## SAMPLE H

## MY FIRST MORNING IN MEXICO

We came on a train late at night and had a hard time finding an American hotel in San Louis Potosi. After finding one we went straight to bed, although my mother took plenty of time to lock and prop the door closed. The next morning I woke up early and looked out of the window. The first thing I saw was a rickety old closed up wagon coming down the street drawn by a few very small borros. This strange looking object was the morning street-car, the driver was standing in front blowing a small tin horn for the people to get out of the way.

Some of the Peons were getting breakfast, the mother sat on the street baking tortellias and the family seated in a circle about her eating as fast as she could bake. The funniest thing about the people eating was that the pigs and dogs ran about the outside of the circle eating the scraps that were thrown them.

Down the street comes a man riding on so small a borro that his feet touch the ground, he is smocking a cigarette and lazily looking about. Behind him walks his wife holding the baby and hiting the borro her husband rides on to make it

go. Behind the wife come the children each carrying something. The houses along the street are made of adobe, all the windows have bars on them which make the house look more like a prison. Over the tops of the buildings can be seen the mountains which have nothing but the century plant on them. Some borros are.

Its literary merit lies in the richness of its imagery and the vividness of its descriptions, which the errors in spelling and structure are not serious enough to spoil.

Sample I represents the best sample found among all the papers written in the composition test at Gary.

#### SAMPLE I

With a jar and a somewhat business like jolt the rickty elevator came to a stop on the basement floor. The door swung open and I stepped out into press-room of the Chicago Tribune.

Surrounded by a mass of quivvering steel I was at a loss to know what to do. I was suddenly confronted by a bearded man clothed in ink smeared overall and jumper. A small tight



shop cap was set jauntily on one side of his head and a pair of steel grey eyes peered at me thru a rather large pair silver ~~rimmed~~ rimmed glasses. He seemed to be saying something to me but the battery of Hoe presses had ~~eenr~~ control of the field and it was only with the greatest difficulty that I could hear what he was trying to tell me.

Beckoning me with an ink stained finger the pressman, for such was the position of this man, piloted me around, under, and even over masses of quivering and roaring steel until we stopped before a press which stood two and one half stories high, a half city block in length and the same in width. The silent pressman paused for a moment to ~~glace~~ glance with pride at the roaring monsters when he motioned me again and mounting an iron stairway with a brass railing we were soon standing on the top deck of this master press. Two and a half stories below me sixteen large rolls of spottlessly white paper were swiftly unrolling into the press. Wheels within wheels whirled and sang and its very song seemed to say "I am the Frank A Munsey the worlds largest newspaper press."

The author of this composition was a twelfth grade student whose specialty lies in the field of journalism.

He is a reporter for the school papers, and as the Gary representative of some of the Chicago dailies had had much experience in writing. The value assigned the composition by the Gary judges was 80. (Median deviation of three judgments 5, average deviation 5.)

**VI. COMPOSITIONS VALUED AT APPROXIMATELY 50  
HILLEGAS IN DIFFERENT SURVEYS**

Reproduced here that the reader may judge of the uniformity of the standard of different examiners using the Hillegas scale.

**PART OF SAMPLE OF COMPOSITION FROM HILLEGAS SCALE  
VALUE 47.4**

First De Quincys mother mind became very meditative.  
was a beautiful woman and  
through her DeQuincy inherited much of his genius.

His running away from school enfluenced him much  
as he roamed through the woods, valleys and his  
The greatest enfluence of De Quincy's life was the opium habit, If it was not for this habit it is doubtful whether we would now be reading his writings.

**SAMPLE OF COMPOSITION FROM TRABUE MODIFICATION OF  
HILLEGAS SCALE VALUE, 49.7**

Next Saturday I should planting the corn, wheat,  
like to go away and have a and oats and other things  
good time on a farm. I planted on farms.  
should like to watch the  
mén plowing the fields and  
Next Saturday I will go  
to the Pioneer meeting if

nothing happens so that I cannot go. I should like to go swimming but it is not warm enough and I would catch a bad cold. I should like to go to my aunts and drive the horses.

I do not drive without some older person with me, so I cannot go very often.

I should like to see my aunts cat and her kittens too. I think I can, to.

PART OF SAMPLE OF COMPOSITION FROM GARY (EIGHTH GRADE), VALUE 50

We were out at camp No 133 which is situated in an near the banks of Deep River. One of the men that stayed at this camp owned a old duck boat which leaked and if you wanted to ride in it you would have to set a certain way or it would fill with water and soon sink.

My brother saw me paddaling around in it and he decided that he would do it himself. He weighed about twenty-five lbs. more than me. I told him the way to set in it but he would not listen but said that one end was as good as the other.

PART OF SAMPLE OF COMPOSITION FROM SALT LAKE CITY (GRADE 7B), VALUE 47.4

One sunny morning in May my five cousins who were on their way to see the fair at Frisco stopped on

their way and came to see me. May father gave me twenty dollars to entertain them. I was busy thinking

of the best way to do it. If finally decided to go to the Bingham Copper Mines. This was satisfactory to all and taking along a lunch we started off.

When we got there it was noon and everybody was hungry so we opened up the lunch and ate until

there was not a crumb left. Next we hired a guide to show us through the mines and what a sight we seen. There were walls of dirt seemingly covered with the yellow mettle. Our guid showed us where the elevators were on which

PART OF SAMPLE OF COMPOSITION FROM BUTTE (EIGHTE  
GRADE), VALUE 50

There are five little children that live near us who are very poor. They seldom have any new clothes and less often any toys.

On Christmas and other days when we children have toys these children may be seen looking at us with longing eyes, and Easter time they even seem envious.

Well I would first buy each child a pair of shoes about three and one half dollars. Then I would buy the girls, three of them, new dresses. The boys new suits. Which would cost about thirty dollars. Of course the girls would have to have hats. I would get simple ones but pretty. Then the boys.

PART OF SAMPLE OF COMPOSITION FROM HACKENSACK, N. J.  
(EIGHTH GRADE), VALUE 49.4

One morning I got up about half-past six in the morning, this was in the country on my vacation and I helped the working-men feed the chickens, give them water and, fill the hoppers with charcoal, oyster shells, grit, bran, meddlins, alfalfa and some other things concerning chickens.

Around noon times the men all got to-gether and opened a small pond, and let the water run out of it, and then got the ground out of it for fertilizer, and dug it out also to make it deeper and to take out all the bogs and things that were unnecessary to be there.

## VII. VOCABULARY OF EIGHTH GRADE COMPOSITIONS

Important Words (i.e., those not found in Jones' List) in Vocabulary of Eighth Grade Children in Froebel, Emerson, and Jefferson Schools. (Excluding Proper Nouns and all Derivations.) Based upon Composition Tests.

## APPENDIX A

| NO. | WORD      | FRE-<br>QUENCY<br>OF USE | NO. | WORD         | FRE-<br>QUENCY<br>OF USE | NO. | WORD        | FRE-<br>QUENCY<br>OF USE |
|-----|-----------|--------------------------|-----|--------------|--------------------------|-----|-------------|--------------------------|
| 1   | adobe     | 1                        | 47  | candle       | 2                        | 93  | exhibition  | 2                        |
| 2   | adventure | 4                        | 48  | captivity    | 1                        | 94  | experiment  | 2                        |
| 3   | airship   | 1                        | 49  | carbon       | 7                        | 95  | exposition  | 1                        |
| 4   | alas      | 1                        | 50  | cast         | 2                        | 96  | extending   | 2                        |
| 5   | alfalfa   | 2                        | 51  | cayuse       | 4                        | 97  | fancy       | 2                        |
| 6   | amazed    | 1                        | 52  | certainly    | 1                        | 98  | fierce      | 1                        |
| 7   | anchor    | 2                        | 53  | chin         | 2                        | 99  | film        | 6                        |
| 8   | ant       | 1                        | 54  | chap         | 1                        | 100 | fishing-rod | 1                        |
| 9   | apart     | 1                        | 55  | chappy       | 1                        | 101 | flapping    | 1                        |
| 10  | apiece    | 2                        | 56  | churn        | 5                        | 102 | flint       | 5                        |
| 11  | arch      | 1                        | 57  | confine      | 1                        | 103 | flap-jack   | 1                        |
| 12  | argued    | 1                        | 58  | consisted    | 1                        | 104 | flowed      | 1                        |
| 13  | arise     | 1                        | 59  | conversation | 1                        | 105 | foggy       | 1                        |
| 14  | arose     | 7                        | 60  | cord         | 1                        | 106 | folks       | 5                        |
| 15  | art       | 2                        | 61  | crouches     | 1                        | 107 | ford        | 5                        |

|    |                |    |               |     |            |    |
|----|----------------|----|---------------|-----|------------|----|
| 16 | aside          | 62 | cow-puncher   | 108 | frantic    | 1  |
| 17 | assorted       | 63 | crabs         | 109 | framed     | 1  |
| 18 | auditorium     | 64 | crackling     | 110 | fuse       | 1  |
| 19 | backdiver      | 65 | crashing      | 111 | gazed      | 1  |
| 20 | backforward    | 66 | crates        | 112 | gig        | 1  |
| 21 | backjack       | 67 | creek         | 113 | glittering | 1  |
| 22 | backstroke     | 68 | crushed       | 114 | graveyard  | 1  |
| 23 | backyard       | 69 | curb          | 115 | grip       | 1  |
| 24 | bang           | 70 | darted        | 116 | grubbing   | 1  |
| 25 | bans           | 71 | decks         | 117 | gulls      | 2  |
| 26 | batch          | 72 | decoration    | 118 | gunwale    | 1  |
| 27 | bedraggled     | 73 | delivery      | 119 | gust       | 1  |
| 28 | beetles        | 74 | demonstration | 120 | harm       | 2  |
| 29 | binding        | 75 | departed      | 121 | haunted    | 1  |
| 30 | birch-bark     | 76 | derby         | 122 | hiking     | 1  |
| 31 | blacksmith     | 77 | destination   | 123 | hind       | 10 |
| 32 | blasting       | 78 | difficulty    | 124 | hips       | 1  |
| 33 | blow-out       | 79 | dingy         | 125 | halloed    | 1  |
| 34 | boon           | 80 | district      | 126 | honking    | 1  |
| 35 | booth          | 81 | dock          | 127 | hounds     | 1  |
| 36 | boy-scout      | 82 | draped        | 128 | hum        | 2  |
| 37 | bouillon       | 83 | drawback      | 129 | humpty     | 1  |
| 38 | bracelet       | 84 | drawbridge    | 130 | hunters    | 1  |
| 39 | brake          | 85 | drenched      | 131 | hurricane  | 1  |
| 40 | breast-stroke  | 86 | dummy         | 132 | hustled    | 1  |
| 41 | brisk          | 87 | dunes         | 133 | husbands   | 3  |
| 42 | broadway       | 88 | eagle         | 134 | huts       | 6  |
| 43 | brother-in-law | 89 | enormous      | 135 | icebergs   | 9  |
| 44 | bucketful      | 90 | errands       | 136 | icecream   | 3  |
| 45 | bunk           | 91 | evidently     | 137 | improvised | 1  |
| 46 | burro          | 92 | exchange      | 138 | incident   | 2  |



## APPENDIX A

## VII (Continued)

| NO. | WORD          | FRE-<br>QUENCY<br>OF USE | NO. | WORD        | FRE-<br>QUENCY<br>OF USE | NO. | WORD       | FRE-<br>QUENCY<br>OF USE | NO. | WORD       | FRE-<br>QUENCY<br>OF USE |
|-----|---------------|--------------------------|-----|-------------|--------------------------|-----|------------|--------------------------|-----|------------|--------------------------|
| 139 | inform        | 1                        | 195 | pottery     | 1                        | 251 | whimpering | 2                        | 251 | whimpering | 2                        |
| 140 | inspected     | 1                        | 196 | prowling    | 1                        | 252 | starvation | 4                        | 252 | starvation | 4                        |
| 141 | instantly     | 1                        | 197 | precipice   | 2                        | 253 | statues    | 2                        | 253 | statues    | 2                        |
| 142 | internal      | 1                        | 198 | previous    | 1                        | 254 | steamship  | 2                        | 254 | steamship  | 2                        |
| 143 | janitor       | 2                        | 199 | promenaded  | 1                        | 255 | sternship  | 2                        | 255 | sternship  | 2                        |
| 144 | kindergarten  | 1                        | 200 | pruner      | 1                        | 256 | stricken   | 4                        | 256 | stricken   | 4                        |
| 145 | knife-dive    | 1                        | 201 | quarter     | 2                        | 257 | struck     | 1                        | 257 | struck     | 1                        |
| 146 | lassoed       | 1                        | 202 | quench      | 1                        | 258 | structure  | 1                        | 258 | structure  | 1                        |
| 147 | lavender      | 1                        | 203 | raft        | 7                        | 259 | struggle   | 1                        | 259 | struggle   | 1                        |
| 148 | legends       | 1                        | 204 | ramble      | 1                        | 260 | suffocated | 1                        | 260 | suffocated | 1                        |
| 149 | liberally     | 1                        | 205 | reality     | 2                        | 261 | surging    | 1                        | 261 | surging    | 1                        |
| 150 | lift          | 2                        | 206 | rear        | 1                        | 262 | swan-dive  | 1                        | 262 | swan-dive  | 1                        |
| 151 | likely        | 1                        | 207 | reared      | 1                        | 263 | swaying    | 1                        | 263 | swaying    | 1                        |
| 152 | located       | 3                        | 208 | reed        | 1                        | 264 | sweetpeas  | 1                        | 264 | sweetpeas  | 1                        |
| 153 | logs          | 3                        | 209 | reel        | 2                        | 265 | tabernacle | 1                        | 265 | tabernacle | 1                        |
| 154 | long-eared    | 1                        | 210 | reflection  | 1                        | 266 | task       | 1                        | 266 | task       | 1                        |
| 155 | looking-glass | 1                        | 211 | relations   | 1                        | 267 | teamster   | 1                        | 267 | teamster   | 1                        |
| 156 | lookout       | 1                        | 212 | removed     | 1                        | 268 | tempest    | 1                        | 268 | tempest    | 1                        |
| 157 | loosened      | 1                        | 213 | reporters   | 1                        | 269 | tent       | 12                       | 269 | tent       | 12                       |
| 158 | luckily       | 1                        | 214 | rescue      | 6                        | 270 | thump      | 3                        | 270 | thump      | 3                        |
| 159 | hulls         | 1                        | 215 | rescuers    | 1                        | 271 | tightening | 1                        | 271 | tightening | 1                        |
| 160 | lured         | 1                        | 216 | resemblance | 1                        | 272 | tiresome   | 1                        | 272 | tiresome   | 1                        |
| 161 | madden        | 2                        | 217 | rewind      | 1                        | 273 | toboggan   | 1                        | 273 | toboggan   | 1                        |
| 162 | marshmallow   | 1                        | 218 | rickety     | 1                        | 274 | tolerate   | 2                        | 274 | tolerate   | 2                        |
| 163 | memory        | 2                        | 219 | rote        | 1                        | 275 | toll       | 1                        | 275 | toll       | 1                        |

|     |                 |     |              |     |               |   |
|-----|-----------------|-----|--------------|-----|---------------|---|
| 164 | method          | 220 | rowboats     | 276 | tome          | 1 |
| 165 | midsummer       | 221 | rumbling     | 277 | torrents      | 2 |
| 166 | midwinter       | 222 | running-dive | 278 | troup         | 1 |
| 167 | millers         | 223 | rut          | 279 | tug           | 2 |
| 168 | monstrous       | 224 | sailors      | 280 | tunnels       | 4 |
| 169 | motorcycle      | 225 | sawdust      | 281 | twister       | 1 |
| 170 | motorman        | 226 | scolding     | 282 | underwater    | 1 |
| 171 | manned          | 227 | scouts       | 283 | unexpected    | 6 |
| 172 | mummy           | 228 | sea-gulls    | 284 | unload        | 1 |
| 173 | cars            | 229 | seasick      | 285 | unlocked      | 1 |
| 174 | obstacle        | 230 | sermonial    | 286 | unusually     | 2 |
| 175 | opposition      | 231 | seaward      | 287 | undertake     | 1 |
| 176 | opossum         | 232 | shaft        | 288 | uneasy        | 1 |
| 177 | originate       | 233 | shone        | 289 | unfortunately | 1 |
| 178 | outfit          | 234 | shotgun      | 290 | unlock        | 1 |
| 179 | overcame        | 235 | showy        | 291 | upstairs      | 2 |
| 180 | overhand-stroke | 236 | sidedive     | 292 | values        | 1 |
| 181 | overlooks       | 237 | sidetrail    | 293 | various       | 1 |
| 182 | overturning     | 238 | signalling   | 294 | violent       | 2 |
| 183 | paddling        | 239 | silence      | 295 | vivid         | 2 |
| 184 | paddler         | 240 | sills        | 296 | vulcanized    | 1 |
| 185 | panic           | 241 | situated     | 297 | western       | 2 |
| 186 | patrol          | 242 | skyrockets   | 298 | whales        | 2 |
| 187 | peons           | 243 | smart        | 299 | wheeler       | 1 |
| 188 | pianist         | 244 | smashed      | 300 | wag           | 1 |
| 189 | pilot           | 245 | snowstorm    | 301 | waistline     | 1 |
| 190 | pitchdark       | 246 | spat         | 302 | wildcat       | 1 |
| 191 | plowed          | 247 | speed        | 303 | woodshed      | 1 |
| 192 | plowing         | 248 | splashed     | 304 | woodworking   | 1 |
| 193 | plover          | 249 | spooky       |     |               | 1 |
| 194 | porters         | 250 | spraying     |     |               | 1 |

### VIII. DETERMINATION OF CRITICAL PARAGRAPH IN GRAY'S ORAL READING SCALE

One of the advantages of Gray's Scale is that its use gives, in effect, a series of measurements of any one individual from which it is possible to gain some idea of the reliability of the results. For instance, the record made by the eighth grade at Gary for paragraph 1 was 204 words per minute; paragraph 2, 196; paragraph 3, 191; paragraph 4, 196; paragraph 5, 186; paragraph 6, 180; paragraph 7, 153; paragraph 8, 143; paragraph 9, 132; paragraph 10, 102; paragraph 11, 108; and paragraph 12, 78 (Table VIII, page 440). For purposes of comparison the rate of reading (actually recorded as the number of seconds required to read each paragraph) has been transposed into the number of words read per minute. The average number of errors made in each paragraph was also found. These data are shown graphically in Figure 1, page 441. In paragraphs 1 to 4 the rate is practically constant and the number of errors two or less. From paragraph 6 on, however, the number of words read per minute falls off rapidly and the number of errors per paragraph increases at a corresponding rate.

It is probable that the curve based upon the rates of reading as given is unreliable because the units of rate

(number of words read per minute) are not equal. In paragraph 1, eighty-five per cent. of the words are of one syllable, while in paragraph 6 twenty four per cent. of the words have two or more syllables. Unfortunately, very little is known about the time required to read words composed of many syllables as compared with the time required for shorter words. On the basis of such data as are available, an estimate has been made of the probable rate in terms of equal units (sound divisions) and this estimate is represented in the figure by the dotted line. A comparison of this curve and the curve for errors will show that in Gary the eighth grade children read at what is practically a uniform rate up to paragraph 6, and the number of errors made in paragraph 6, while more than in paragraph 1, has barely exceeded the two errors per paragraph which are permissible under Gray's Standard 4. From this point on, however, the eighth grade children encounter difficulties, for the rate of reading rapidly falls. The median paragraph for the grade (see this report Figure 43, page 267) is, therefore, probably two paragraphs beyond the type of material the eighth grade Gary children are able to read easily and without conscious effort. Paragraph 6 is apparently the critical paragraph and probably represents the most difficult material the Gary children should be judged able to read satisfactorily. Comparisons with results from other cities, however, should be made on the basis of results previously reported.

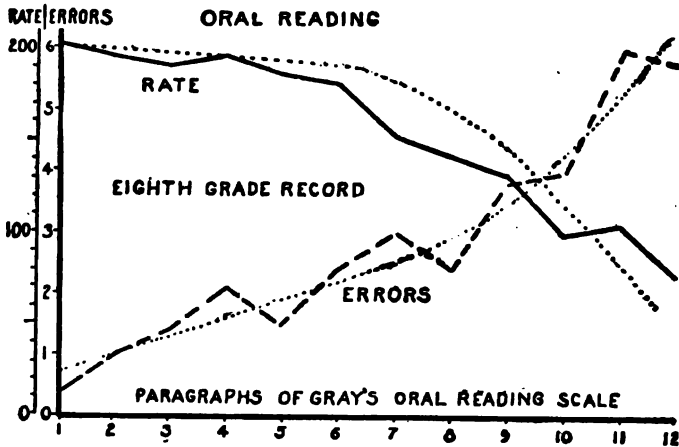
TABLE VIII

RATE OF READING AND NUMBER OF ERRORS FOR EACH PARAGRAPH OF GRAY'S ORAL READING SCALE<sup>1</sup>

| PARAGRAPH                                      | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10   | 11  | 12  |
|------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|
| No. of Children Reading Each Paragraph.....    | 52  | 52  | 52  | 52  | 52  | 52  | 52  | 50  | 47  | 44   | 38  | 27  |
| Average Rate of Reading. Words per Minute..... | 204 | 196 | 191 | 196 | 186 | 180 | 153 | 143 | 132 | 102  | 108 | 78  |
| Average Number of Errors                       | .36 | .91 | 1.4 | 2.1 | 1.5 | 2.4 | 3.0 | 2.4 | 3.8 | 4.02 | 6.1 | 5.8 |

<sup>1</sup> Based on records of eighth grade children.

FIGURE 1  
RATE OF READING AND NUMBER OF ERRORS



The diagram shows rate of oral reading and number of errors made by eighth grade children when measured by the Gray Oral Reading Scale.

The scale along the base of the figure represents the paragraphs in Gray's Scale. The scale along the vertical axis marked "Rate" represents the number of words read per minute. The scale along the vertical axis marked "Errors" represents the number of errors made per paragraph. The curves represent eighth grade median scores for 52 children up to and including paragraph 7. Only 50 children are represented in the scores for paragraph 8, and in similar fashion the number of children reading each paragraph declines to 27 for paragraph 12. This variation in the number of children reading the different paragraphs accounts for some of the irregularities in the curves.

The heavy solid line represents the curve for rate of reading. The heavy broken line represents the number of errors made per paragraph.

It will be noted that the rate of reading decreases so slowly from paragraphs 1 to 6 that the rate is practically constant, but paragraphs 7, 8, and 9 and the succeeding paragraphs are read much more slowly. As the rate decreases, the number of errors increase.

FIGURE 1—*Continued*

The curve for rate of reading is based upon the number of words irrespective of the length. Each paragraph of the scale, however, contains words of a larger number of syllables than the preceding paragraphs. It is probable that could the rate of oral reading be measured in terms of a constant unit, the curve would approximate the dotted line shown in the figure.

From the curves the inference is drawn that paragraph 6 is a critical paragraph for the Gary children. Up to and including paragraph 6, the children read at a rate which is not determined by the paragraph, and the number of mistakes per paragraph is approximately two. From this point on, however, the change in rate and in the number of errors is rapid.

## IX. THE METHOD OF SCORING READING AND REPRODUCTION TESTS

There are no well established methods of scoring the attempts of children to reproduce a story which they have read silently. Accordingly, the method followed in the Gary survey will be explained in detail.

Part of one of the stories used for the Reproduction Test is shown in Figure 2, page 446. This was analyzed by giving each main thought a key letter. Each element in the idea was called a point and given a number. The general scheme is also illustrated in Figure 2.

No two persons would analyze the material in the same way, and it is even difficult for one person to be consistent throughout. However, the advantage of this form of analysis is that it enables the examiner to trace the action of memory in the process of reproduction. The analysis of each paper shows plainly which elements were recalled and in what order. The reader should note that, as analyzed, the paragraph yields 8 ideas and 43 points.

The papers written by the children were scored by means of this key and marked for quantity and quality of reproduction. The number of units reproduced was taken as the quantity score. As the test was used primarily for the purpose of determining the rate of repro-



duction, the children were stopped at the end of exactly three minutes. This fact was taken into consideration in determining the accuracy scores. The quality, or accuracy, of reproduction was taken as the ratio between the points exactly reproduced and the points in the original from the beginning up to the most advanced point found in the reproduction.

For instance, in the poorest eighth grade paper found (Fig. 3, pages 447-8) in three minutes a boy wrote but 16 words, and reproduced but 3 of the 22 main ideas in the story, down to the word "pepper." Therefore, his quantity score is 3. He reproduced but 8 points out of 116 points in the original and one additional point was transformed ("was late" for "came down late"). His quality score, or accuracy, is  $\frac{1}{19}$ , or seven per cent.

Of the two best eighth grade papers one is a paper which reproduces a large number of main ideas, the other a paper which reproduces most exactly the material read (Figure 4, pages 448-9). The first child wrote 83 words in three minutes, the second, 62. In the 83 words were 13 ideas, yet the accuracy of reproduction, as measured by the points exactly reproduced, was but 33 per cent. The second paper, however, had an accuracy of 70 per cent. In this case the paper written by the child is very closely an exact reproduction of the original story.

A third type (Figure 5, pages 449-50) is the paper which represents most nearly the median scores for the eighth grade (eight ideas reproduced with an accuracy of 33 per cent.).

One other illustration will be discussed (Figure 6, pages 450-51), a sample which makes it very evident that the quality of the reproduction is determined by something more than mere comprehension of the meaning of the passage read. In this case the boy reproduced 3 out of the five units correctly, and out of the 15 points which occur in the reproduction test but 4 are given exactly as they appear in the original. Two of the points are additions and the rest are transposed or transformed in some way. His scores are 3 units and 15 per cent. accuracy. The reproduction is much below the average of the class, but the cause is not failure to read or failure to understand. His rate of reading is 136 words per minute<sup>1</sup> (median for his grade, 204), his average scores in the Kansas Reading Test (average of scores in Tests I, II, and III) is 15.3 points attempted (corresponding grade score, 23.9), but his accuracy of reading in the Kansas Test is 91 per cent. as compared with 83 per cent. for his grade. In other words, he is a slow but careful reader who comprehends what he reads better than the average. His score in composition was 39 Hillegas (grade 45.8), and he has low scores in spelling and in the Trabue Tests.

In view of all these facts, therefore, it would seem safer to infer limited capacity and special difficulty in all language work as an explanation rather than lack of comprehension in reading.

While conclusions may not be based on a single case,

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<sup>1</sup>Test II, 136; Test III, 123; Test IV, 134.

even a single exception may show the existence of a problem in need of careful study. Any one scoring a set of papers from a reproduction test will find plenty of evidence that ability in composition enters so largely into reproduction that until a suitable investigation has been made it is unwise, to say the least, to judge of comprehension in reading by means of reproduction. Accordingly, while the general records for Gary given above would appear to represent a poor quality of work in the reproduction test, the author infers that the cause of the low scores is to be sought more in the difficulties of the children in reading, spelling, and the mechanics of English composition than in mere failure to comprehend what is read.

FIGURE 2  
ANALYSIS OF SAMPLE EIGHTH GRADE PARAGRAPH OF THE READING  
AND REPRODUCTION TEST

ORIGINAL PARAGRAPH

Fred came down late to breakfast one morning, so late that all the other members of the family were through, and had gone about their respective duties. But though he had slept late, Fred was still sleepy; for he had staid up until twelve o'clock the night before, whereas he was usually in bed by nine. To tell the truth, he was also rather cross,—as most boys are apt to be when they are sleepy,—and as he took his seat, he said: "Pshaw" there's nothing on the breakfast table."

# APPENDIX A

447

| KEY        |                                                                                                                                                                                                                                                                |        |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| MAIN IDEAS | SUBDIVISIONS                                                                                                                                                                                                                                                   | POINTS |
| 1 A        | Fred came down late to <u>breakfast one morning</u>                                                                                                                                                                                                            | 6      |
| 2 B        | <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u><br>So late that all the other members of the family<br><u>1</u> <u>2</u> <u>3</u><br><u>were through</u> and <u>had gone about</u> their respective<br><u>4</u> <u>5</u> <u>6</u><br>duties.<br><u>7</u> | 7      |
| 3 C        | <u>But though he had slept late,</u> Fred was still sleepy                                                                                                                                                                                                     | 4      |
| 4 D        | <u>1</u> <u>2</u> <u>3</u> <u>4</u><br>For he had staid up until twelve o'clock the night before<br><u>1</u> <u>2</u> <u>3</u> <u>4</u>                                                                                                                        | 4      |
| 5 E        | Whereas he was usually <u>in bed by nine</u>                                                                                                                                                                                                                   | 5      |
| 6 F        | <u>To tell the truth,</u> he was also rather cross                                                                                                                                                                                                             | 5      |
| 7 G        | <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u><br>As cross as most boys are apt to be when they are sleepy.                                                                                                                                                      | 5      |
| 8 H        | <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u><br>And as he took his seat, he said; "Pshaw there's<br><u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u><br>nothing on the breakfast table.<br><u>6</u> <u>7</u>                                                       | 7      |
|            |                                                                                                                                                                                                                                                                | 43     |

In the upper half of the figure the paragraph is given as it appeared in the Test. In the lower half of the figure it is given as it appeared in the key used in scoring. Each division of the paragraph considered to represent a distinct major thought or idea is given a key letter, and each element in the idea is called a point and given a number. The important connectives and unusual modifiers are considered as separate elements. The words underlined are considered single points. As a whole, the paragraph yields 8 ideas and 43 points.

FIGURE 3

## THE POOREST EIGHTH GRADE REPRODUCTION

### REPRODUCTION

Fred was late for breakfast one morning  
there was nothing on the table except some pepper

## APPENDIX A

## ANALYSIS

Total ideas in portion of original passage reproduced—22. Total points—116. Ideas reproduced—3. Points exactly reproduced—8. Quantity score—3. Accuracy score—7 per cent.

Record    A    A    A    A    A    H    H    H    V  
              1    2    4    5    6    5    6    7    3

The line is drawn around  $A_2$  to show that the idea, while reproduced, has been transformed or altered in the reproduction. For meaning of the points represented by  $A_4$ ,  $A_5$ , etc., see key Figure 2.

FIGURE 4

## THE BEST TWO EIGHTH GRADE REPRODUCTIONS

## FIRST PAPER

## REPRODUCTION

Fred got up very late one morning and was very cross and still sleepy he was up until twelve o'clock the night before when he generally goes to sleep at nine. He went to the table and all the rest of the family was through and he called kate but Kate did not hear as she was feeding the poultry in the back yard.

He then said lazily nothing on the table and he put his head down and pretty soon he began to

Record C A F F C C D D D D E E E E X  
           1 6 4 5 3 4 1 2 3 4 1 3 4 5  
B B B I I I K K K L L L L L L  
           2 3 4 1 2 4 3 4 5 1 2 6 7 5 4  
       H H I H H H M M O P P  
           2 3 3 5 6 7 1 2 1 2

The record on this page represents the largest amount (number of main ideas) reproduced, and the record on page 449 represents the greatest accuracy of reproduction.

## ANALYSIS

Total ideas in portion of original passage reproduced—16. Total points—79. Ideas reproduced—13. Points exactly reproduced—28. Quantity score—13. Accuracy score—35.

## SECOND PAPER

## REPRODUCTION

Fred came down to the breakfast table late, All the other members of the family had finished and were doing their respective duties. Although Fred had slept long he was still sleepy, for he had gone to bed at twelve o'clock the night before, whereas he was usually in bed at nine. To tell the truth he was also cross, as boys

|        |   |     |   |   |     |   |   |   |     |     |   |   |     |     |   |   |
|--------|---|-----|---|---|-----|---|---|---|-----|-----|---|---|-----|-----|---|---|
| Record | A | A   | A | A | (X) | A | B | B | (B) | (B) | B | B | (C) | (C) | C | C |
|        | 1 | 2   | 3 | 5 |     | 4 | 2 | 3 | (4) | (5) | 6 | 7 | (1) | (2) | 4 | 3 |
|        | D | (D) | D | D | E   | E | E | E | E   | F   | F | F | F   | G   | G |   |
|        | 1 | (2) | 3 | 4 | 1   | 2 | 3 | 4 | 5   | 1   | 2 | 3 | 5   | 1   | 2 |   |

## ANALYSIS

Total ideas in portion of original passage reproduced—7. Total points—36. Ideas reproduced—7. Points exactly reproduced—25. Quantity score—7. Accuracy score—70.

## FIGURE 5

## A MEDIAN EIGHTH GRADE REPRODUCTION

## REPRODUCTION

Fred came downstairs one day for breakfast but he was late for he had just gone to bed at twelve the other night and could not get up in time and when he came to

the table he was lazy and said "Theres nothing on the table" Then he sat down and began to call out "Kate" "Kate" but Kate never came because she was feeding the chickens in the yard. Then all at once he began to sneeze.

Record A A A (X) (A) (A) (X) A D (D) D D (X)  
 1 2 3 6 5 4 1 2 3 4  
 (X) (A) A (X) I H H H H (H) I (X) I  
 1 2 3 3 5 6 7 1 2 4  
 I J (J) (J) L L L L L O O (P) P  
 5 2 1 3 1 2 6 7 5 2 3 1 2  
 P  
 3

The line is drawn around A to show that the idea, while reproduced, has been transformed or altered in the reproduction. For meaning of points represented by A, A, etc., see key, Figure 2, page 446. The symbol X represents addition or ideas not found in the test.

#### ANALYSIS

Total ideas in portion of original passage reproduced—16. Total points—79. Ideas reproduced—8. Points exactly reproduced—26. Quantity score—8. Accuracy score—33.

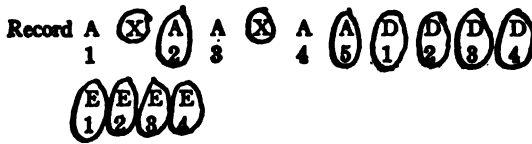
FIGURE 6  
 REPRODUCTION BY PUPIL OF LITTLE ABILITY

#### REPRODUCTION

Fred was a boy how who had came down from his bed room lat for dinner and was lat because he had been out untill twelve that night when his usal bedtime was.

# APPENDIX A

451



The line is drawn around <sup>2</sup>A to show that the idea, while reproduced, has been transformed or altered in the reproduction. For meaning of points represented by <sup>1</sup>A, <sup>2</sup>A, etc., see key, Figure 2, page 446. The symbol X represents addition or ideas not found in the test.

## ANALYSIS

Total ideas in portion of original passage reproduced—5. Total points—26. Ideas reproduced—3. Points exactly reproduced—4. Quantity score—3. Accuracy score—15 per cent.



## X. VARIABILITY AND ITS SIGNIFICANCE

To provide an objective illustration of variation in individual scores, the performances of the members of a certain eighth grade class in a very simple test will be discussed. A test in copying figures<sup>1</sup> was given five times. It involves a minimum of thought elements and measures simply the writing reaction time. The score is the number of figures written per minute without regard to quality. The starting and stopping signals were given by means of an automatic timing device. The tests were considered by the children as a game, and under practice their scores rose rapidly.

The median score of the group of 22 eighth grade children was 100 figures on the initial test (Tuesday). On the second testing day (Thursday), when three trials were given in succession, the first trial resulted in a score of 103.5 a gain of 3.5 figures; the second trial in 111 figures, a further gain of 7.5 figures; and the third trial in 115 figures, a further gain of 4 figures. When the test was given for the fifth time (on the following Tuesday) there was no further improvement, the score being 115 figures (Table IX, page 454).

The scores of individual children, however, vary in

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<sup>1</sup>Taken from Courtis Standard Research Tests, Series A, Test 5.

quite a different fashion. Two children improved twenty figures between the first and second trials. The score of another child declined ten figures. A third child made his highest score on the third trial, while still another made precisely the same score in three trials, a slightly higher score in the fourth trial and a lower score in the fifth trial.

The variations in the performances of individual members of a class may be accounted for in different ways. When taking the first test some of them proceeded cautiously and suspiciously. They eyed closely the stranger who gave the test and devoted a good deal of their attention to the timing device. They had various thoughts and emotional reactions to which their conscious attention was mainly given. But when they had taken one test and knew what to expect they began to put forth effort. They tried to excel their own scores and those of their neighbors. The competitive spirit developed and their scores rose.

For others, taking the test was itself a species of training. Their abilities developed because their initial abilities were, for the most part, far below their capacities. Some of the children became more skillful in turning over their papers quickly and getting to work, others learned to hold their attention rigidly to the task, others made their figures less carefully, and others in still different ways succeeded in writing a larger number of figures with each trial.

On the other hand, factors of quite a different character

TABLE IX  
SCORES AND DEVIATIONS IN COPYING FIGURES-

| INDIVIDUALS              | SCORE IN TRIALS |       |      |      |      | MEDIAN SCORE | CHANGE IN SCORE |           |           |           | From Highest to Lowest Scores Made |
|--------------------------|-----------------|-------|------|------|------|--------------|-----------------|-----------|-----------|-----------|------------------------------------|
|                          | 1               | 2     | 3    | 4    | 5    |              | Trial 1-2       | Trial 2-3 | Trial 3-4 | Trial 4-5 |                                    |
| 1 H. W.                  | 81              | 78    | 90   | 92   | 92   | 90           | -3              | +12       | +2        | 0         | 14                                 |
| 2 C. R.                  | 80              | 90    | 100  | 100  | 98   | 96           | +10             | 0         | +7        | +5        | 20                                 |
| 3 M. N.                  | 85              | 98    | 98   | 105  | 106  | 98           | +13             | 0         | 0         | +5        | 21                                 |
| 4 G. H.                  | 90              | 97    | 100  | 100  | 105  | 100          | +7              | +10       | 0         | +5        | 15                                 |
| 5 R. W.                  | 87              | 95    | 105  | 105  | 102  | 102          | +8              | +13       | 0         | -3        | 18                                 |
| 6 S. W.                  | 72              | 92    | 105  | 111  | 102  | 102          | +20             | +13       | +6        | -9        | 39                                 |
| 7 D. R.                  | 92              | 102   | 103  | 110  | 115  | 103          | +10             | +15       | +7        | +31       | 23                                 |
| 8 V. E.                  | 100             | 90    | 105  | 104  | 135  | 104          | -10             | +10       | +1        | +9        | 45                                 |
| 9 W. E.                  | 97              | 105   | 115  | 105  | 115  | 105          | +8              | +13       | -9        | +5        | 18                                 |
| 10 H. R.                 | 100             | 97    | 110  | 120  | 115  | 110          | +3              | +4        | +4        | -6        | 23                                 |
| 11 T. N.                 | 102             | 108   | 112  | 116  | 110  | 110          | +5              | +15       | +5        | 0         | 14                                 |
| 12 W. F.                 | 90              | 95    | 110  | 115  | 115  | 110          | +7              | +8        | +10       | +2        | 15                                 |
| 13 I. R.                 | 110             | 113   | 105  | 115  | 120  | 113          | +3              | +20       | 0         | 0         | 17                                 |
| 14 B. W.                 | 100             | 107   | 115  | 115  | 115  | 115          | +8              | 0         | 0         | 0         | 20                                 |
| 15 I. H.                 | 103             | 95    | 115  | 115  | 115  | 115          | -9              | +4        | +1        | 0         | 10                                 |
| 16 E. L.                 | 106             | 115   | 115  | 116  | 116  | 116          | +20             | +4        | +4        | -9        | 28                                 |
| 17 P. C.                 | 101             | 121   | 125  | 129  | 120  | 121          | +5              | +18       | +5        | -11       | 28                                 |
| 18 C. I.                 | 105             | 110   | 128  | 133  | 122  | 122          | +10             | +2        | +13       | 0         | 25                                 |
| 19 G. M.                 | 110             | 120   | 122  | 135  | 135  | 123          | +1              | +14       | +5        | +1        | 21                                 |
| 20 R. A.                 | 108             | 108   | 123  | 128  | 129  | 123          | 0               | +5        | +11       | -16       | 16                                 |
| 21 S. E.                 | 130             | 130   | 130  | 141  | 125  | 130          | +14             | 0         | +10       | -7        | 29                                 |
| 22 B. J.                 | 121             | 135   | 140  | 150  | 143  | 140          | +7              | +9        | +4.5      | 0         | 20.5                               |
| Median                   | 100             | 103.5 | 111  | 115  | 115  | 110          | +7              | -         | -         | -         | -                                  |
| Standard Deviation       | 9               | 8.5   | 7    | 10   | 8    | 8            | -               | -         | -         | -         | -                                  |
| Coefficient of Variation | 13.3            | 13.6  | 11.8 | 14.2 | 12.5 | 11.8         | -               | -         | -         | -         | -                                  |
| Bulky                    | 13.3            | 13.1  | 10.6 | 12.3 | 10.8 | 10.7         | -               | -         | -         | -         | -                                  |

<sup>1</sup>Based on the scores of an eighth grade class in five trials of a test in copying figures.

This table is to be read as follows: Individual No. 1 (Initials H. W.) copied 81 figures on the first trial of the test, 78 on the second trial of the test, 90 the third trial, 92 the fourth trial, and 92 the fifth trial. His true rate was taken as 90 figures per minute the median of the five scores. Between the first and second trial, his score fell 3 points, in the next trial it rose 13 points, on the next 2, and did not increase on the last trial. The difference between his lowest and highest score was 14 points.

produced variations in the opposite direction. A boy trying too eagerly used force enough to break his pencil point and lost time finding another pencil. A girl stopped in the middle of a test to pin up a curl that bothered her by swinging before her eyes. A boy sneezed and took out his handkerchief. After one or two trials a girl who was slow became discouraged and thereafter wrote listlessly without real effort.

The performances of the children in the class cover a zone about fifty five figures wide. More than half the children have a difference between the highest and lowest score made of twenty figures or more, while the corresponding difference from the class as a whole is but fifteen figures. The pupil who had the most constant results (No. 16) has a variation between highest and lowest scores of ten figures. It should be evident, therefore, that ability to copy figures cannot be determined for the individual by a single test; that the performances of both the individual and of the class change from test to test under the play of many forces; that the ability of the individual can be inferred with certainty only from a whole series of tests which make evident the conditions under which variations take place. For the class, however, the single test is much more significant, for the group score and the group variations do not change greatly in subsequent tests. The coefficients of correspondence<sup>1</sup> in the five trials of the copying of figures test, based upon the individual scores of the

<sup>1</sup>For an explanation of this measure of relationship see p. 475.

42 eighth grade children present in all tests, bring out the effect of these chance variations in destroying the apparent correlations (Table X). The scores in Test I, for instance, bear about the same relation to the scores in Test IV that the results from any two educational tests would bear (50 per cent.). On the other hand, there is almost perfect correspondence (98 per cent.) between the scores of the children as determined by the median of five trials, and the scores on the second trial. After the second trial the factors of turning papers, making poorer figures, etc., begin to distort the

TABLE X

COMPARATIVE RESULTS OF DIFFERENT TRIALS IN COPYING FIGURES<sup>1</sup>

| TEST I             | MEDIAN | MEDIAN DEVIATION | TOTAL RANGE |
|--------------------|--------|------------------|-------------|
| Trial I            | 100    | 10               | 46-121      |
| " II               | 110    | 10               | 60-135      |
| " III              | 115    | 10               | 62-145      |
| " IV               | 117    | 8                | 65-145      |
| " V                | 117.5  | 7.5              | 60-140      |
| W. S. <sup>2</sup> | 114    | 11               | 60-135      |

PERCENTAGES OF TOTAL CASES WHICH DO NOT VARY IN RELATIVE POSITION MORE THAN ONE UNIT OF VARIABILITY

| TRIALS             | I  | II | III | IV | V  | W. S. |
|--------------------|----|----|-----|----|----|-------|
| I                  | —  | 76 | 74  | 50 | 57 | 69    |
| II                 | 76 | —  | 90  | 81 | 74 | 98    |
| III                | 74 | 90 | —   | 83 | 71 | 93    |
| IV                 | 50 | 81 | 3   | —  | 83 | 83    |
| V                  | 57 | 74 | 71  | 83 | —  | 91    |
| W. S. <sup>2</sup> | 69 | 98 | 93  | 83 | 91 | —     |

<sup>1</sup>Based on the scores of 42 eighth grade pupils.<sup>2</sup>W. S. means weighted score, the score taken as most representative of each individual's ability.

scores so that they no longer represent the thing the tests are designed to measure.

The scores of this group of children illustrate another important and exceedingly interesting point. The standard deviation (based on the class median) for the scores representing the median performances of each individual (11.8) is smaller than that for any single trial of the test, except the third, which has the same value. In other words, the effect of the variation in individual scores is to increase the apparent range of variation within the class. On the basis of the results of a single test, individuals within classes appear to differ more in ability than they really do.

For instance, a group of 22 fifth grade children was selected, each member of which had the same median score for the five trials (95). That is, they represented a group of children of equal ability in copying figures as far as that ability can be determined by five trials of the test (Table XI, page 458, Figure 7, page 460). The real variability of the group is zero, yet two individuals (Nos. 1 and 2) on the first trial had very low scores which totally misrepresent their true abilities; two other individuals (Nos. 15 and 19) had very high scores in the fifth trial, which similarly misrepresent their true abilities.<sup>1</sup> Similar extreme scores

<sup>1</sup>These last two are from the same class and it might be thought that in this class an error in timing had been made. However, an inspection of the class medians and class distributions shows that they are precisely similar to those of other classes of the same grade, and that these two individual scores are simply erratic variations.

TABLE XI  
VARIATION IN SCORES OF CHILDREN OF EQUAL ABILITY<sup>1</sup>

| INDIVIDUAL<br>NUMBER | AGE | SCHOOL    | GRADE | SCORES    |           |           |           |           | DIFFERENCE<br>BETWEEN<br>HIGHEST<br>AND LOWEST<br>SCORES |
|----------------------|-----|-----------|-------|-----------|-----------|-----------|-----------|-----------|----------------------------------------------------------|
|                      |     |           |       | 1ST TRIAL | 2ND TRIAL | 3RD TRIAL | 4TH TRIAL | 5TH TRIAL |                                                          |
| 1                    | 13  | Froebel   | 5C    | 25        | 95        | 105       | 110       | 95        | 85                                                       |
| 2                    | 11  | "         | 5B    | 27        | 90        | 100       | 105       | 95        | 78                                                       |
| 3                    | 11  | "         | 5B    | 60        | 95        | 125       | 90        | 95        | 65                                                       |
| 4                    | 11  | "         | 5B    | 65        | 95        | 92        | 110       | 95        | 45                                                       |
| 5                    | 14  | Beveridge | 5A    | 68        | 100       | 105       | 110       | 95        | 42                                                       |
| 6                    | 9   | Froebel   | 5B    | 70        | 100       | 95        | 95        | 90        | 30                                                       |
| 7                    | 12  | "         | 5B    | 75        | 90        | 95        | 95        | 95        | 20                                                       |
| 8                    | 12  | "         | 5B    | 75        | 90        | 95        | 98        | 95        | 23                                                       |
| 9                    | 11  | Jefferson | 5C    | 75        | 90        | 95        | 100       | 95        | 25                                                       |
| 10                   | 10  | Froebel   | 5B    | 75        | 90        | 100       | 116       | 95        | 41                                                       |
| 11                   | 11  | Emerson   | 5A    | 80        | 85        | 95        | 116       | 98        | 36                                                       |
| 12                   | 12  | Froebel   | 5A    | 80        | 95        | 91        | 95        | 107       | 27                                                       |
| 13                   | 14  | "         | 5A    | 80        | 95        | 93        | 99        | 102       | 22                                                       |
| 14                   | 10  | "         | 5B    | 81        | 90        | 95        | 100       | 100       | 19                                                       |
| 15                   | 11  | Beveridge | 5C    | 85        | 80        | 95        | 105       | 150       | 70                                                       |
| 16                   | 14  | Froebel   | 5C    | 85        | 95        | 90        | 95        | 102       | 17                                                       |
| 17                   | 9   | Jefferson | 5A    | 85        | 95        | 95        | 100       | 95        | 15                                                       |

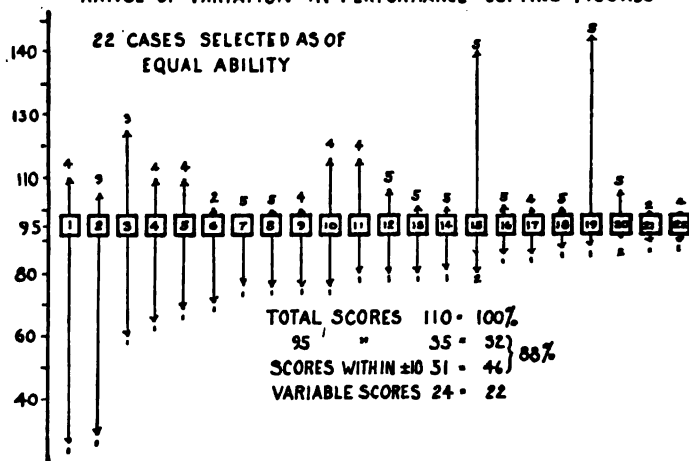
|                            |    |           |      |      |      |      |      |      |
|----------------------------|----|-----------|------|------|------|------|------|------|
| 18                         | 10 | 5B        | 87   | 97   | 90   | 95   | 100  | 13   |
| 19                         | 10 | Beveridge | 88   | 95   | 95   | 95   | 100  | 67   |
| 20                         | 13 | Fröebel   | 91   | 90   | 95   | 100  | 105  | 16   |
| 21                         | 12 | Jefferson | 92   | 99   | 95   | 96   | 90   | 9    |
| 22                         | 10 | "         | 95   | 90   | 90   | 98   | 96   | 8    |
| Median                     |    |           | 80   | 92.5 | 95.0 | 99.5 | 95.0 | 26.0 |
| Standard Deviation         |    |           | 18.5 | 4.4  | 7.5  | 7.3  | 17.9 |      |
| Coefficient of Variability |    |           | 23.1 | 4.7  | 9    | 7.3  | 18.9 |      |

<sup>1</sup>The 22 fifth grade children were selected as of equal ability on the basis of a median performance of 95 in five trials of the test in copying figures.

This table is to be read as follows: Individual No. 1, a fifth grade child, 13 years old, in the 5C group of the Fröebel school, made a score of 25 figures in the first trial of the test of copying figures; 95 on the second; 105 on the third; 110 on the fourth; and 95 on the fifth. The difference between the highest and lowest score made in the five trials is 85. His median score is 95. In similar fashion each one of the 22 children had a median score of 95 figures copied per minute.



FIGURE 7  
 VARIATION IN PERFORMANCES OF CHILDREN OF EQUAL ABILITY  
 RANGE OF VARIATION IN PERFORMANCE COPYING FIGURES



The scale along the left hand vertical axis represents the number of figures copied per minute. The squares represent individual children. The arrows show the range of variation from the lowest to the highest score; thus, the lowest score made by individual 1 was 25 figures per minute on the first trial, the highest score was 110 figures per minute on the fourth trial; the point of the arrow in each case showing the lowest or highest score, and the figure just beyond the arrow showing the number of the trial in which the score was made.

Individuals Nos 2, 3, 15, and 19 show great variation. Individuals Nos. 16, 17, 18, 20, 21, and 22 show very small variation. The 22 individuals had 110 scores in the five trials; 35 of these scores were 95 figures per minute, 51 other scores were within 10 points above or below 95. That is, 88 per cent. of the scores fell within 10 points of 95. Twenty four scores, or 22 per cent. of the total, show a variation exceeding 10 points from 95.

occur in Test I, in Test II, and in each of the other tests. Only seven children (Nos. 14, 16, 17, 18, 20, 21 and 22) show a total range of less than 20 figures, yet 88 per cent. of all the scores fall within ten figures of 95. In general, only very seldom would a test be given to a group of 20 or more children without securing scores which would misrepresent grossly the abilities of at least 2 children.

One phase of the question still remains to be discussed—the relation of variation in performance to the measurement of individual ability. All that has been said so far has tended to emphasize the unreliability of individual performance in a single test, and the reader might easily get the idea that tests were utterly worthless. The truth of the matter is that for eighty to ninety per cent. of the children a single test yields a fairly reliable measure. For half the children the results are perfectly satisfactory. For any group taken as a whole the chance variations offset each other, so that class scores may be depended upon. Generalized scores based upon city wide distributions of a large number of cases reveal with absolute certainty the general level of achievement under the given conditions.

Many persons seem disinclined to accept general results as valid when they know that some of the individual results are unreliable. It is easy to show, however, that in general the individual results are reliable and that such variations as occur fall within certain general limits. That is, an individual tends to maintain his general level in the group, so that when the results of a

TABLE XII

## RELATIVE INDIVIDUAL STANDINGS IN A SERIES OF TESTS

The Scores of 48 Eighth Grade Children Present for All Tests Have Been Reduced to Comparable Measures by Expressing the Deviation of Each Score from the Median of the Group in Terms of the Median Deviation of the Group.

| Subject  | No. | Test                      | RECORD OF INDIVIDUAL WHOSE AVERAGE RATIO WAS THE |         |        |
|----------|-----|---------------------------|--------------------------------------------------|---------|--------|
|          |     |                           | Highest                                          | Average | Lowest |
| General  | 1   | Age                       | -1.0*                                            | -1.0    | -2.0   |
|          | 2   | Copying Figures           | +1.0                                             | -.3     | +2     |
|          | 3   | "                         | +1.5                                             | -.5     | +1.0   |
|          | 4   | "                         | +3.0                                             | -.3     | -.3    |
|          | 5   | "                         | +2.9                                             | -.3     | -.3    |
|          | 6   | "                         | +1.8                                             | -.3     | -.3    |
|          | 7   | "                         | +1.6                                             | -.3     | -.3    |
|          | 8   | Cancellation of Triangles | -1.0                                             | +3.0    | +1.0   |
|          | 9   | Number Right Form "2"     | -.3                                              | +2.4    | +1.1   |
| Average  |     |                           | +.94                                             |         |        |
| Writing  | 1   | Rate                      | -1.0                                             | +.6     | -1.7   |
|          | 2   | Quality                   | +1.0                                             | -1.0    | 0      |
|          | 3   | "                         | +1.5                                             | -1.0    | -1.0   |
| Average  |     |                           | +.37                                             |         |        |
| Spelling | 1   | Accuracy                  | +.8                                              | -.5     | -1.7   |
|          | 2   | Spelling Coefficient      | +1.5                                             | +.5     | -3.0   |
|          | 3   | Slips                     | +1.8*                                            | +.2     | -5.2   |
|          | 4   | Misspellings              | +1.0                                             | +.3     | -5.3   |
|          | 5   | Total Errors              | +1.6*                                            | +.3     | -3.5   |
|          | 6   | Average                   | +1.8*                                            | +.5     | -1.0   |
| Average  |     |                           | +1.42                                            |         |        |
| Average  |     |                           | +.26                                             |         |        |
| Average  |     |                           | -.92                                             |         |        |
| Average  |     |                           | -3.80                                            |         |        |

TABLE XII (Continued)

TABLE XII (Continued)

| Subject | No. | Test             | Highest | Average | Lowest |
|---------|-----|------------------|---------|---------|--------|
| Reading | 1   | Silent Reading   |         |         |        |
|         | 2   | "                |         |         |        |
|         | 3   | Reproduction     |         |         |        |
|         | 4   | "                |         |         |        |
|         | 5   | "                |         |         |        |
|         | 6   | "                |         |         |        |
|         | 7   | "                |         |         |        |
|         | 8   | "                |         |         |        |
|         | 9   | Kansas Silent    |         |         |        |
|         | 10  | "                |         |         |        |
|         | 11  | "                |         |         |        |
|         | 12  | "                |         |         |        |
|         | 13  | "                |         |         |        |
|         | 14  | "                |         |         |        |
|         | 15  | "                |         |         |        |
|         | 16  | "                |         |         |        |
|         | 17  | "                |         |         |        |
|         | 18  | Timbus Scale     |         |         |        |
|         | 19  | "                |         |         |        |
|         | 20  | "                |         |         |        |
|         | 21  | "                |         |         |        |
|         | 22  | "                |         |         |        |
|         | 23  | "                |         |         |        |
|         | 24  | "                |         |         |        |
|         | 25  | "                |         |         |        |
|         |     | Rate Test 2      | 4       | 23      | 17     |
|         |     | " " 2            | +1.3    | +1.6    | +1.7   |
|         |     | Actual Points    | +1.1    | +1.0    | +1.0   |
|         |     | % Points         | +1.0    | +1.0    | +1.0   |
|         |     | Actual Ideas     | +1.0    | +1.0    | +1.0   |
|         |     | % Ideas          | +1.0    | +1.0    | +1.0   |
|         |     | Average Score    | +1.0    | +1.0    | +1.0   |
|         |     | Score Test 1     | +1.0    | +1.0    | +1.0   |
|         |     | " " 2            | +1.0    | +1.0    | +1.0   |
|         |     | Rate " 2         | +1.0    | +1.0    | +1.0   |
|         |     | " " 2            | +1.0    | +1.0    | +1.0   |
|         |     | Accuracy Test 1  | +1.0    | +1.0    | +1.0   |
|         |     | " " 2            | +1.0    | +1.0    | +1.0   |
|         |     | Score Scale B    | +1.0    | +1.0    | +1.0   |
|         |     | " " C            | +1.0    | +1.0    | +1.0   |
|         |     | " " D            | +1.0    | +1.0    | +1.0   |
|         |     | Rate " E         | +1.0    | +1.0    | +1.0   |
|         |     | Accuracy Scale D | +1.0    | +1.0    | +1.0   |
|         |     | Average          | +1.0    | +1.0    | +1.0   |
|         |     |                  | + .70   | + .59   | -1.66  |

|                                   | HIGHEST | AVERAGE | LOWEST |
|-----------------------------------|---------|---------|--------|
| Average Rate .....                | +1.26   | .45     | -1.52  |
| Average Accuracy or Quality ..... | +       | .03     | -2.81  |
| Average Miscellaneous .....       | +       | .51     | -2.18  |
| Average of All .....              | +       | .90     | -2.17  |
| Median of All .....               | +       | .89     | -1.75  |
|                                   | +1.0    | 0       |        |

## DISTRIBUTION

|             | HIGHEST |    | AVERAGE |    | LOWEST        |    |    |
|-------------|---------|----|---------|----|---------------|----|----|
|             | No.     | %  | No.     | %  | No.           | %  |    |
| 2.0 or over | 9       | 12 | 11      | 14 | Above 0       | 5  | 6  |
| 1.5 to 1.9  | 19      | 24 | 5       | 6  | 0 to -.4      | 11 | 14 |
| 1.1 to 1.4  | 4       | 5  | 11      | 14 | -.5 to -.9    | 8  | 10 |
| 1.0         | 15      | 19 | 7       | 9  | -1.0 to -1.4  | 8  | 10 |
| .5 to .9    | 8       | 10 | 6       | 8  | -1.5 to -1.9  | 8  | 10 |
| 0 to .4     | 10      | 13 | 7       | 9  | -2.0          | 3  | 4  |
| Negative    | 13      | 17 | 9       | 12 | -2.1 to -2.4  | 2  | 3  |
|             |         |    | 7       | 9  | -2.5 to -2.9  | 5  | 6  |
|             |         |    | 15      | 19 | -3.0 to -3.4  | 5  | 7  |
|             |         |    |         |    | -3.5 to -3.9  | 5  | 7  |
|             |         |    |         |    | -4.0 or lower | 17 | 23 |

\*All ratios marked (\*) have had the signs changed to make + mean better than the median. Thus a child older than the median age, or making more mistakes in grammar in his composition than the median of the class, has been marked —.

Beginning on page 462, the table is to be read as follows: The individual who had the highest average ratio stood one unit below the median in age; the median in the first trial of the test in copying figures, 1.5 units above the median in the second trial of copying figures, etc. Nine, or 12 per cent. of his ratios, indicate a position 2 or more units above the median; 19 ratios, or 24 per cent., were from 1.5 to 1.0 units above the median; and so on. The average of all his ratios was .89 units.

number of different tests are available his general ability is evident. Of course allowance must be made for the variations in capacity which make for personality. One child excels in mathematics and is poor in English, one may even be strong in addition and weak in subtraction. But in general, the consistency of an individual's scores is made evident by any comparison of the results of an extended series of tests.

When the variability ratios<sup>1</sup> of any individual are available in many different tests the average ratio may be taken as a measure of the individual's general ability. On the assumption (probably unwarranted) that all the individuals compared have had equal opportunities for training, this average ratio would represent a measure of relative capacity. Such average ratios were obtained for the 42 eighth grade children present in all tests.

The ratio of the individual having the highest average ratio is consistently from 0 to 2 units above the median (Table XII, page 462, Figure 8, page 467). In but fifteen per cent. of the cases does the ratio fall below the median and these are offset by an equal number of exceptionally high scores. In most of the tests, the child's scores place him in the group in his correct position as exactly as "general ability" has a constant value.

Similarly, the results for other children show equal consistency. The performances of the less able individuals tend to be more variable and, therefore, less reliable, but in from sixty to eighty per cent. of the cases a single

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<sup>1</sup>For an explanation of this measure of relative position, see p. 475.

FIGURE 8,  
RANGE OF INDIVIDUAL VARIATION IN DIFFERENT TESTS

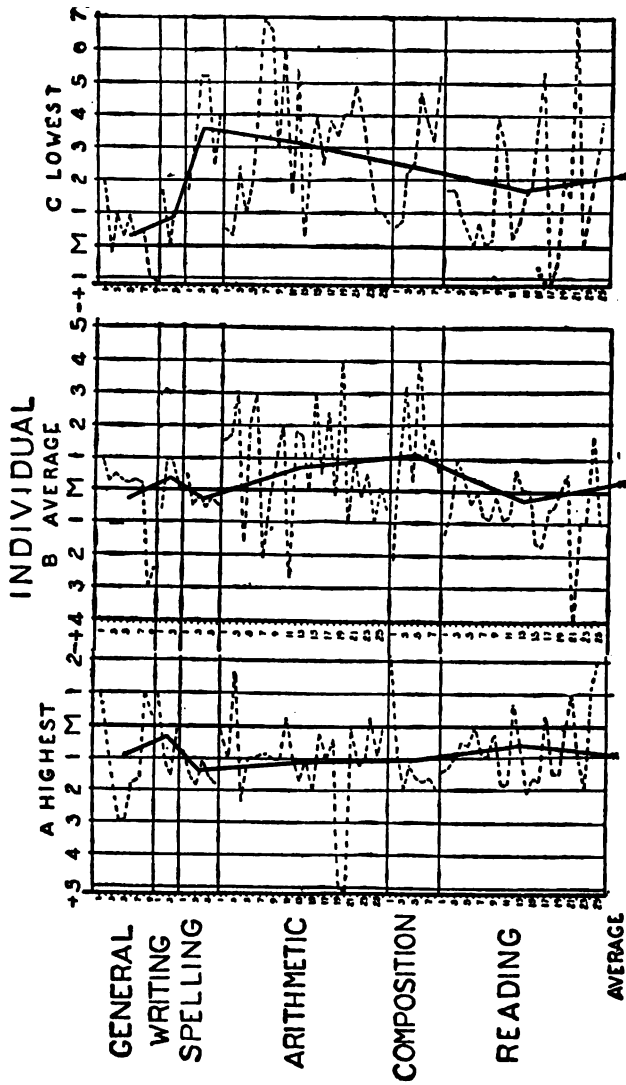




FIGURE 8—*Continued*

The scales along the top of the figure show relative position within the group. *M*=median. The unit is the median deviation from the median. The figures along the scale at the left of the different figures represent the various tests in Table XII, page 462. The dotted lines represent the actual scores of 3 individuals in the group of 42 eighth grade children present for all tests. *A* represents the individual having the highest average score, *B* the most consistently median individual, and *C* the individual having the lowest average score. The solid lines are based upon the average values for the different subjects.

The curves make evident the extreme range of variation in performance in any one test, and the reliability of scores based upon many tests. For instance, individual *A* ranges from nearly the lowest position in the class to the highest in single tests, yet in each subject his average position is closely the same as for all. The same is true of *B*, and to a lesser extent, of *C*. The curves show the individual differences of children. Thus relatively, *B* is weak in writing, strong in spelling, weak in arithmetic and composition, and strong in reading. The graph also tends to show that the less able individuals exhibit greater fluctuations in performance than the more able.

test affords a fairly accurate indication of the ability of the individual (within one unit of variability). The reliability of group results is due both to the fact that the individual results are in general reliable, and to the additional fact that such variations as occur are as likely to take place in the direction of higher scores as of lower.

The variability of a group of children is greater in the more complex tests than in the simple ones. Children are more alike, for instance, in the rate at which they copy figures, which involves merely control of muscular action (coefficient of variability .10) than they are in a

TABLE XIII  
FACTORS AFFECTING PERFORMANCE  
COMPARATIVE VARIABILITY IN DIFFERENT TESTS<sup>1</sup>

| NO.                         | TEST                                   | GROUP<br>MEDIAN | MEDIAN<br>DEVIATION | PER CENT. OF<br>VARIATION |
|-----------------------------|----------------------------------------|-----------------|---------------------|---------------------------|
| RATE OF WORK                |                                        |                 |                     |                           |
| 1                           | Copying Figures.....                   | 114             | 11                  | 10                        |
| 2                           | Writing—Free-choice Test.....          | 93              | 12                  | 13                        |
| 3                           | Timed Trabue.....                      | 16              | 2.2                 | 14                        |
| 4                           | Composition.....                       | 59              | 8.2                 | 14                        |
| 5                           | Points Attempted—Kansas Reading.....   | 27.3            | 4.8                 | 18                        |
| 6                           | Silent Reading.....                    | 204             | 40                  | 20                        |
| 7                           | Cancellation Triangles.....            | 20              | 4                   | 20                        |
| 8                           | Addition—Examples Attempted.....       | 8               | 2                   | 25                        |
| 9                           | Multiplication—Examples Attempted..... | 8               | 2                   | 25                        |
| QUALITY OR ACCURACY OF WORK |                                        |                 |                     |                           |
| 10                          | Composition.....                       | 43.5            | 4                   | 9                         |
| 11                          | Kansas Reading.....                    | 86              | 9                   | 10                        |
| 12                          | Timed Trabue.....                      | 75              | 8                   | 10                        |
| 13                          | Handwriting.....                       | 40              | 5                   | 12                        |
| 14                          | Multiplication.....                    | 74              | 15                  | 20                        |
| 15                          | Addition.....                          | 61              | 14                  | 23                        |
| 16                          | Spelling.....                          | 55              | 20                  | 36                        |

<sup>1</sup>Based on the scores of 43 eighth grade pupils present for all tests.

<sup>2</sup>Standard Deviation 29. Coefficient of Variability 53 per cent.

test for rate of reading, which involves mental elements (coefficient .20), or in a test of adding or spelling, which measures the results of a long course of training (addition .25) (Table XIII, page 469). The more complex the mental activity involved, that is, the more the activity is a direct product of a long and complex series of trainings, the greater should be the variability, because those of greater capacity respond to training more readily. If the training were continued long enough, the more able might tend to reach a maximum and thereafter further training might operate to reduce variability. But at all times, other conditions being equal, the greater the complexity of the ability tested, the greater the variability is likely to be.

The fact gives added significance to the tests of simple mechanical skills. For Gary, and for other similar experiments, the claim is sometimes made that they are "attempting to meet new demands for a more practical education by the selection and organization of a curriculum strictly in terms of the activities and environments of both children and adults."<sup>1</sup> In such experiments, however, the aims which are set up as desirable are always less clearly defined and very much more complex than the simple work in conventional schools. It is extremely probable, therefore, that unless measurement proves that the new curriculum is so well organized and administered that it controls more effectively the

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<sup>1</sup>Control of Educational Progress through Educational Experimentation. School and Society, Vol. 1, No. 126, Meriam.

forces acting in the relatively simple problems of equipping children with the essential tools by which all mental work is done, the efficiency of the work directed toward the attainment of the higher ends will be correspondingly lower. So far, no schools seem to have met successfully this test of controlling the simpler and more mechanical phases of education. Yet educational problems are not to be considered solved because one's aim is worthy or one's theory plausible. In the opinion of the writer, to be considered wholly successful, classroom teaching must result in a reduction of the present variability in the final product.

## XI. STATISTICAL TERMS AND METHODS

An important detail of survey work is the choice of methods by which the results of educational tests are prepared for publication. Readers unfamiliar with statistical procedure will find in appropriate textbooks full explanations of the general terms and methods used. Each investigator, however, is likely to modify general methods to suit his own needs. In this section are given explanations of these methods which are peculiar to this report.

### MEDIAN DEVIATION

The measure of variability most frequently used in this report is median deviation. This measure bears the same relation to the deviations from the median that the median bears to the scores.

It is found by an approximate method. Any distribution of scores is converted into a distribution of deviations as follows:

|            |   |   |   |   |    |   |   |          |                               |
|------------|---|---|---|---|----|---|---|----------|-------------------------------|
| Scores     | 3 | 4 | 5 | 6 | 7  | 8 | 9 | Scores   | Median Score 5.8 <sup>1</sup> |
| Frequency  | 7 | 2 | 5 | 4 | 3  | 3 | 1 | Children |                               |
| Frequency  |   |   | 5 | 6 | 10 | 3 | 1 | Children |                               |
| Deviations |   |   | 0 | 1 | 2  | 3 | 4 | Steps    | Median Deviation 1.7          |

<sup>1</sup>Or 5.7, if the mid point of the median score is taken.

The five children whose scores are 5 each are considered to have no deviation from the median, the two children whose scores are 4 and the four children whose scores are 6 are considered to form a single group of 6 whose scores are one step away from the median. Similarly, there are ten children ( $7+3$ ) whose scores are two steps away, three children three steps away, and one whose score is four steps away from the median. The median deviation is the thirteenth in order of size and this is found in precisely the same fashion as the median, with one exception. The median is considered as falling at the midpoint of its step, consequently, the deviations in the table above represent the mid-points of the steps and not their beginning. To be consistent with the practice followed in other tables of the report, the deviations should be labeled 0, 0.5, 1.5, 2.5 and 3.5 respectively, but the method is much easier to explain in the form given. The corrected median deviation is found as follows:  $5+6=11$ ,  $13-11=2$ ,  $2\div 10=.2$ ,  $1.5+.2=1.7$ .

The semi-interquartile range is 1.68.

The mid-point of the median deviation is 1.65.

#### CITY WIDE SCORES

City wide median scores were derived from distributions of individual scores formed by consolidating the distributions for the different classes of a given grade, not by finding the median of the class medians. The A, B, and C sections of the classes in the different schools were first combined separately then merged into the

single distribution for the grade. The median score based on this distribution is treated as the scores of the city for the given grade.<sup>1</sup>

#### GENERALIZED SCORES

The function of the measurements made in the survey was conceived to be the determination of the general level of abilities of the different grades at Gary. Consequently, although the median score of every class in every school was found and graphed, in the general tables only the "*generalized* city wide scores" are given. That is, small irregularities in the various development curves derived from city wide scores were smoothed out, sometimes by averaging the scores of a given grade with those of the grade above and below, sometimes graphically, and sometimes by arbitrary adjustments. The amount of such adjustment is everywhere small and some measure of its amount is always reported. The resulting generalized curves, therefore, represent the general trend of the development of ability at Gary minus the small irregularities that normally occur in every school system from year to year.

As an illustration of this process of consolidation and generalization, the different stages for the scores in the dictation spelling tests will be shown.

In Table XIV are given the class and grade distribution for all the *fifth grade* classes tested at Froebel. In Table XV the class medians for *all* classes taking this

<sup>1</sup>See last four columns of Table XIV on page 476.

test are given in full, and in Figure 9, page 479, the various school curves are shown in relation to the city wide grade scores and the generalized scores.<sup>1</sup> It will be observed that the generalized curves make for simplicity of presentation and ease of understanding and that it accurately reflects the general trend of the development.

#### CORRELATION

One other type of statistical method employed in this report needs discussion and explanation, namely, correlation. By correlation is meant the degree of relation which exists between two abilities. For instance, one may well ask the question, "Is good spelling dependent upon (more precisely, does it occur associated with) good writing?" One would answer this question with an unqualified "yes" if the best writer in the class proved to be also the best speller, if the second best writer the second best speller, and so on, the worst writer proving to be the worst speller. Such correspondence would be called perfect correlation and is practically never found. The causes operating to produce variation are too many and too varied to permit of perfect correspondence, and the real problem is to determine the precise degree of relationship existing between the two abilities. For the relationship may (theoretically) vary from perfect correspondence through no correspondence to an inverse relationship in which the best writer would be the worst speller, and so on (negative correlation).

<sup>1</sup>See also Fig. 14, page 84.



## **APPENDIX A**

AND THE FOLLOWING INFORMATION IS BEING FURNISHED TO YOU:

[illegible]

| Actual Median from Individual Scores      | 35.0 | 22.5 | 45.0 | 52.5 | 40.0 | 57.5 | 50.0 | 65.0 | 45.0 | 60.0 | 60.0 | 35.0 | 50.0 | 55.0 | 50.0 |
|-------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Computed Median                           | 36.7 | 25.0 | 48.3 | 55.0 | 45.0 | 60.0 | 52.5 | 66.2 | 50.0 | 62.5 | 65.0 | 39.3 | 55.0 | 60.0 | 50.9 |
| Difference                                | 1.7  | 2.5  | 3.3  | 2.5  | 5.0  | 2.5  | 2.5  | 1.2  | 5.0  | 2.5  | 5.0  | 4.3  | 5.0  | 5.0  | .9   |
| Average                                   | 36.6 | 26.2 | 42.3 | 52.3 | 42.1 | 55.9 | 53.6 | 60.1 | 54.1 | 58.3 | 58.5 | 36.3 | 52.5 | 56.9 | 49.2 |
| Actual Med. Dev. of Individual Deviations | 10.0 | 17.5 | 15.0 | 17.5 | 15.0 | 17.5 | 20.0 | 15.0 | 25.0 | 20.0 | 15.0 | 15.0 | 15.0 | 20.0 | 20.0 |
| Computed Med. Dev.                        | 11.4 | 18.8 | 17.5 | 17.0 | 20.0 | 16.7 | 18.5 | 15.0 | 27.0 | 22.5 | 17.5 | 16.3 | 17.1 | 21.0 | 19.3 |
| Difference                                | 1.4  | 1.3  | 2.5  | .5   | 5.0  | .8   | 1.5  | 10.0 | 2.0  | 2.5  | 2.5  | 1.3  | 2.1  | 1.0  | .7   |

\*P = Froebel, E = Emerson, J = Jefferson, B = Beveridge.

This table is to be read as follows: In 5C, Class No. 30, Froebel school, one child had a score of 75 per cent. accuracy, one of 70 per cent., one of 65 per cent., 3 of 55 per cent., and 50 on. There were 35 children in the class. The actual median score was found to be 35, but the class score computed from the distribution by the approximate method was 36.7 per cent., a difference of 1.7 per cent. The average score was 36.6 per cent. The actual median deviation was 10.0 per cent., the median deviation computed from the distribution was 11.4 per cent., a difference of 1.4 per cent.

There are three 5C classes, Nos. 30 and 31 Froebel, and No. 11 Jefferson. The three distributions are consolidated into the single distribution called 5C. This in turn was combined with the 5B and the 5A distribution, giving a distribution representing the scores of all the fifth grade children in the city. That is, of the 312 fifth grade children tested, 4 had scores of 100 per cent. accuracy, 4 of 95 per cent., etc. See also Table XVIII, page 90.

TABLE XV

CLASS AND CITY WIDE AVERAGE ACCURACY OF SPELLING IN THE DICTATION SPELLING TEST<sup>1</sup>

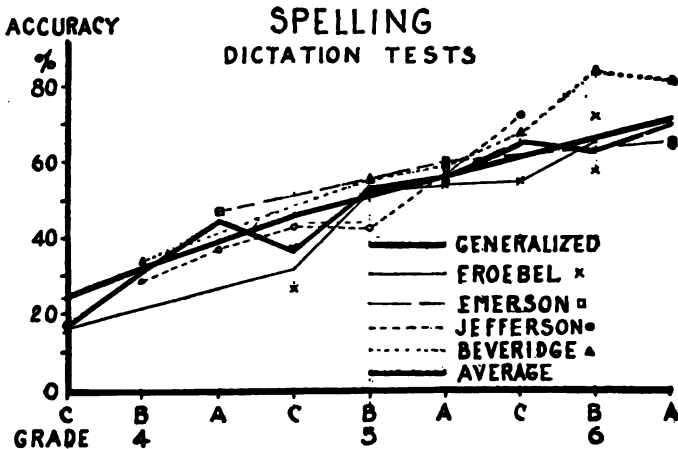
| GRADE | CLASS NO. | PROEBEL | CLASS NO. | EMERSON | CLASS NO. | JEFFERSON | CLASS NO. | BEVERIDGE | CITY WIDE | GENERALIZED |
|-------|-----------|---------|-----------|---------|-----------|-----------|-----------|-----------|-----------|-------------|
| 4C    | 32        | 16.6    |           |         |           |           | 8         | 16.5      | 16.5      | 24          |
| 4B    |           |         |           |         |           | 28.0      | 8         | 34.0      | 31.5      | 32          |
| 4A    |           |         |           | 47.0    | 12        | 36.8      |           |           | 44.5      | 39          |
| 5C    | 30        | 36.6*   |           |         | 11        | 42.3*     |           |           | 36.3*     | 45          |
| 5B    | 31        | 26.2*   |           |         |           |           |           |           |           |             |
| 5A    | 37        | 52.3*   |           |         |           |           |           |           |           |             |
| 6C    | 33        | 53.6*   |           |         | 10        | 42.1*     | 10        | 55.9*     | 52.5*     | 50          |
| 6B    | 38        | 54.5    |           | 60.1*   | 10        | 54.1*     | 10        | 58.5*     | 56.9*     | 56          |
| 6A    | 39        | 57.5    |           |         | 15        | 58.3*     |           |           |           |             |
| 6B    | 40        | 57.5    |           |         | 13        | 72.0      | 11        | 67.0      | 66.0      | 61          |
| 6A    | 41        | 72.0    |           |         |           |           | 11        | 83.6      | 62.5      | 66          |
|       |           |         |           | 65.5    |           |           | 11        | 81.5      | 69.7      | 71          |

<sup>1</sup>For all classes taking the same test as that taken by fifth grade classes, whose scores are shown in Table XIV.

\*Taken from Table XIV.

This table is to be read as follows: The average accuracy of spelling in the dictation test was for Class No. 38 Froebel, 16.6 per cent.; for Class No. 8 Beveridge 16.5 per cent.; for the two classes combined 16.5 per cent. However, as but two classes contributed to the combined score, and as an inspection of the scores made by other classes proved that 16.5 per cent. was a relatively low score, the "generalized city wide" score for the 5C grade was arbitrarily set at 24 per cent., as the score conforming most nearly to the general trend of the development curve as a whole. The reader should notice that the generalized score for the 4C grade (24 per cent.) differs but .5 per cent. from the true value, and that most of the other differences are small (average difference 3.6 per cent.) five differences being positive and four negative. That is, the curve based upon "generalized scores" is a smooth curve which represents the general development of ability at Cary without showing small irregularities. See also Table XVIII, page 50.

FIGURE 9  
RELATION BETWEEN ACTUAL AND GENERALIZED SCORES



The scale along the base of the figure indicates grades, that along the left hand vertical axis the average accuracy of spelling. Each X represents a score made by a class in the Froebel school; each square a class in the Emerson school, each circle a class in the Jefferson school, and each triangle a class in the Beveridge school. The development curves for the various schools are shown, also the curve (double line) based upon the generalized score.

The graph shows that spelling ability at Gary should be represented by a zone about 20 per cent. wide. That is, in any one grade the difference between the best and worst of the school curves is approximately 20 per cent. The curve based on the generalized scores runs through the centre of the zone.

For other illustrations of relation between actual and generalized curves, see Figure 2, page 19; Figure 14, page 84; Figure 52, page 295.

In this report correlation is used *only* to bring out certain general relations between tests. No extended or

careful studies are attempted. Consequently, the method of correlation used and the precision of the results are of little moment; it is the general degree of correlation only that matters. Accordingly, a special method of correlation has been employed, a method which lends itself to simple definition and to graphic presentation. The details of this method will now be explained.

For the purposes of this report, correlation may be defined as the extent to which the members of any group maintain the same relative position within the range of scores for one test that they hold in the scores for a second test, the extent, that is, to which the children that are high, average, or low in one test are high, average, or low in the other also.

The degree of correlation is measured by a coefficient of correspondence. That is,

(1) The position of each child in the group in both tests is expressed in common terms, and (2) from a comparison of these common measures of position, (3) the percentage of children who maintain the same relative positions in the two distributions is easily determined by counting and computation. This percentage will be taken as the coefficient of correspondence.

Measurement of relative position is made in terms of units of variability.<sup>1</sup> A score which is either higher or lower than the median by an amount equal to the median

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<sup>1</sup>See Thorndike *Mental and Social Measurements*, page 158, and *Comparable Measures*, Kelly, *Journal of Educational Psychology*, December, 1914.

deviation is considered at a unit distance from the median. That is, the steps in finding such measures of relative positions are (1) finding the deviation of each score from the median, denoting differences derived from scores larger than the median by plus signs and from scores smaller than the median by minus signs, (2) finding the median of these deviations, and (3) dividing each deviation by the median deviation, carrying the results to tenths. The resulting ratios are the measures of relative position desired.

The method of transmuting scores in different tests into comparable measures of relative position rests upon the assumption that the range of scores in one test necessary to include the half of the cases which vary least from the median is equivalent to the range of scores in the other test necessary to include the corresponding cases. As scores in different tests are not directly comparable, some such assumption must be made. For educational work the median deviation seems to the author to be the most suitable measure of variability to use.

The final step in determining the coefficient of correspondence is the comparison of the variability ratios. If child A is 2.1 units above the median in one test and 2.0 units above the median in the other, it is apparent at once that he has maintained the same position in the two tests within a tenth of a unit. On the other hand, if child B is + 2.1 in one test and - 1.7 in the other test, it is equally clear that he has changed his position in the group 3.8 units. The number of children out of the

entire group who maintain the same positions within any desired degree of exactness is thus easily determined, and the per cent. that this number is of the total number in the group constitutes the coefficient of correspondence.

The size of the coefficient will depend not only upon the real degree of correspondence between the two abilities tested but also upon the reliability of each test. For if the conditions of the testing are such that large chance variations may occur, exact correspondence could not be expected, even though the relationships between the two abilities were perfect. In the previous chapter, the chances that variation in score will occur were shown to be very great, and in general it is found that even for the most perfect tests, closer range of correspondence than one unit is not to be expected. In this report, the coefficients of correspondence are, in general, taken arbitrarily as the percentages of the groups which maintain their relative positions in the two distributions within one unit of variability.

Empirical experimentation proves that in certain cases the coefficient of correspondence agrees quite closely with the Pearson product-moment coefficient of correlation,<sup>1</sup> but that in other cases there is little resemblance. In this report, however, the Pearson coefficient (based on the median as the measure of central tendency) is given in all situations in which it might seem to be at all significant.

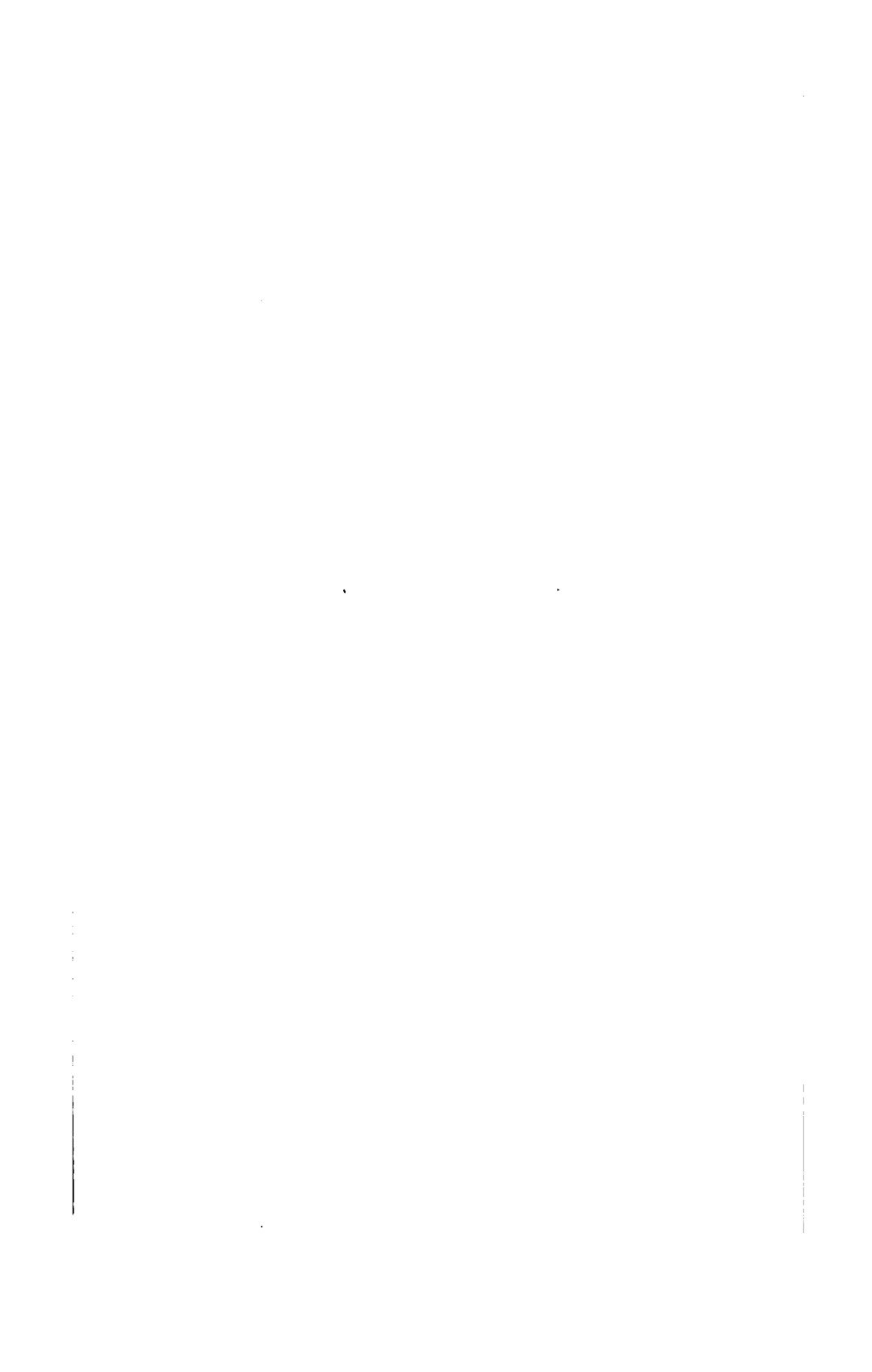
<sup>1</sup>For a normal distribution it is probable that a coefficient based on the number of cases which maintain the same position within three quarters of a unit of variability would correspond more closely with the Pearson product-moment coefficient based on the same scores.

## APPENDIX B

This appendix contains directions for giving the various tests, and illustrations of actual papers written by children, of answers and score cards, and of tabulation sheets.

|                           |     |
|---------------------------|-----|
| I. HANDWRITING . . . . .  | 485 |
| II. SPELLING . . . . .    | 494 |
| III. ARITHMETIC. . . . .  | 498 |
| IV. COMPOSITION . . . . . | 508 |
| V. READING. . . . .       | 514 |





## I. HANDWRITING

### FREE CHOICE TEST

*Instructions.*—On the day before the test, give to each teacher a copy of the test paper. Tell her that her class will be tested in handwriting the next day, and ask her to have the class practice writing the test paragraph so that the children may become familiar with its contents.

On entering a room, say: "We are going to have a handwriting test to-day. Please take out your pens and blotters and get ready to write. I will give each of you one of these papers (holding the paper before the class) but do not write anything until I ask you to."

When all are supplied, say: "Fill out the blanks at the top of the paper; your name, boy or girl, age, grade, and class. Now lay your pens down and read the instructions out loud with me."

Read the instructions with the class, making sure that all take part. Then say: "The instructions mean that when I say 'Start' you are to copy as much of the paragraph (pointing) as you can in the time allowed. You will be marked both for how much you write and how well you write. Do not begin until I say 'Start.' and stop as soon as I give the signal."

When all are ready, say: "Get Ready. Hands up. Start." Allow exactly two minutes. Then say "Stop." Have the papers exchanged.

Pass the answer cards, have the first two lines filled out, then have the cards exchanged to correspond with the papers. Show the children how to count the number of letters written by means of the answer cards. Have the score written on the card in the space provided. Collect cards and papers.

#### DICTATION TEST: HANDWRITING AND SPELLING

*Instructions.*—On entering a room, say: "We are to have a dictation spelling test to-day. Take out your pens and blotters, and get ready to write. I will give each of you a sheet of this paper. Please do not begin to write until I tell you to."

Distribute the test papers. When all are supplied have the blanks at the top of the paper filled out.

Then say: "I am going to dictate ten sentences. Lay your pens down while I read them to you, so you will understand them easily when I ask you to write."

Read the sentences at the rate of about ten letters per second (slowly). Then say: "Now take your pens and get ready to write. I shall not repeat at all, so listen carefully. If you have not finished a sentence when I start dictating the next, stop writing, omit the rest of the sentence, and listen, but try to write fast enough to

## TEST PAPER

Test No. 9  
Handwriting

THE GARY PUBLIC SCHOOLS

SCORES

Amount

Quality

Name *Kenneth Thompson* Date *Apr 12 Sub. 89* Class *14*

## INSTRUCTIONS:

When the examiner gives the signal to start, copy as much of the following material as you can in the time allowed. Your writing will be scored for both speed and quality.

"Four score and seven years ago our fathers brought forth upon this continent a new nation, conceived in liberty and dedicated to the proposition that all men are created equal. Now we are engaged in a great civil war testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battlefield of that war."

Lincoln's Gettysburg Speech.

*Four score and seven years ago our  
fathers brought forth upon this con-  
tinent a new nation, conceived in  
liberty and dedicated to the proposition  
that all men are created equal. Now we  
are engaged in a great.*

ANSWER AND RECORD CARD<sup>1</sup>

|                                                          |                         |                          |
|----------------------------------------------------------|-------------------------|--------------------------|
| 16                                                       | The Gary Public Schools | EMERSON                  |
| Name <u>Louis Rappaport</u>                              | Test 9                  |                          |
| Boy or Girl <u>Age</u> <u>12</u>                         | Grade <u>8A</u>         | Class <u>14</u>          |
| Total number of letters copied in two minutes <u>168</u> |                         |                          |
| Quality <u>45</u>                                        | <u>45</u>               | <u>35</u> Rate <u>84</u> |
|                                                          | <u>40</u>               | Median Quality _____     |
| Scored by _____                                          |                         |                          |

<sup>1</sup>Under quality, the score under nine is the quality score for the Free Choice Test, under seven, for the handwriting in the Dictation Tests, under eight, for the handwriting in the Composition Test.

(The small figures at the end of any word show the total number of letters up to the end of that word.)

Fourscore, and <sup>12</sup> seven <sup>17</sup> years <sup>22</sup> ago <sup>26</sup> our <sup>28</sup> fathers <sup>35</sup> brought <sup>42</sup> forth <sup>47</sup> upon <sup>51</sup> this <sup>55</sup> continent <sup>64</sup> a <sup>66</sup> new <sup>68</sup> nation <sup>74</sup> conceived <sup>88</sup> in liberty <sup>92</sup> and <sup>95</sup> dedicated <sup>104</sup> to <sup>106</sup> the <sup>109</sup> proposition <sup>120</sup> that <sup>134</sup> all <sup>127</sup> men <sup>130</sup> are <sup>133</sup> created <sup>140</sup> equal. <sup>145</sup> Now <sup>148</sup> we <sup>150</sup> are <sup>153</sup> engaged <sup>159</sup> in <sup>162</sup> a <sup>163</sup> great <sup>168</sup> civil <sup>173</sup> war <sup>176</sup> testing <sup>183</sup> whether <sup>190</sup> that <sup>194</sup> nation <sup>200</sup> or <sup>202</sup> any <sup>205</sup> nation <sup>211</sup> so <sup>213</sup> conceived <sup>222</sup> and <sup>225</sup> so <sup>227</sup> dedicated <sup>233</sup> can <sup>239</sup> long <sup>243</sup> endure. <sup>249</sup> We <sup>251</sup> are <sup>254</sup> met <sup>257</sup> on <sup>259</sup> a <sup>260</sup> great <sup>265</sup> battlefield <sup>274</sup> of <sup>278</sup> that <sup>282</sup> war. <sup>285</sup>

# TABULATION SHEET

Class Jefferson 8th 18  
 Gary Public Schools  
 Record Sheet  
**HANDWRITING**  
 Est. Randomburg Date 5/11/16 - Hour 10-15  
 School \_\_\_\_\_ Class No. \_\_\_\_\_ Grade \_\_\_\_\_  
 Scores—Speed 105 Quality 44.4 Efficiency \_\_\_\_\_

| SPEED   | QUALITY AYRES SCALE |    |    |    |    |    |    |    |    | Frequency Score |
|---------|---------------------|----|----|----|----|----|----|----|----|-----------------|
|         | Under 20            | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |                 |
| 180-189 |                     |    |    |    |    |    |    |    |    |                 |
| 160-169 |                     |    | 1  |    |    |    |    |    |    | 1               |
| 150-159 |                     |    |    |    |    |    |    |    |    |                 |
| 140-149 |                     |    |    | 2  | 1  |    |    |    |    | 3               |
| 130-139 |                     |    | 1  | 1  | 2  |    |    |    |    | 4               |
| 120-129 |                     |    | 2  | 3  |    |    |    |    |    | 5               |
| 110-119 |                     |    |    | 2  |    |    |    |    |    | 3               |
| 100-109 |                     | 1  |    |    |    |    |    |    |    |                 |
| 95-99   |                     |    | 1  | 2  | 1  | 1  |    |    |    | 5               |
| 90-94   |                     |    | 3  |    | 1  |    |    |    |    | 4               |
| 85-89   |                     |    |    | 3  |    |    |    |    |    | 3               |
| 80-84   |                     |    |    | 3  | 1  |    |    |    |    | 4               |
| 75-79   |                     |    |    |    |    |    |    |    |    |                 |
| 70-74   |                     |    |    |    |    |    |    |    |    |                 |
| 65-69   |                     |    |    |    |    |    |    |    |    |                 |
| 60-64   |                     |    |    |    |    |    |    |    |    |                 |
| 55-59   |                     |    |    |    |    |    |    |    |    |                 |
| 50-54   |                     |    |    |    |    |    |    |    |    |                 |
| 45-49   |                     |    |    |    |    |    |    |    |    |                 |
| 40-44   |                     |    |    |    |    |    |    |    |    |                 |
| 35-39   |                     |    |    |    |    |    |    |    |    |                 |
| 30-34   |                     |    |    |    |    |    |    |    |    |                 |
| 25-29   |                     |    |    |    |    |    |    |    |    |                 |
| 20-24   |                     |    |    |    |    |    |    |    |    |                 |
| 15-19   |                     |    |    |    |    |    |    |    |    |                 |
| 10-14   |                     |    |    |    |    |    |    |    |    |                 |
| 5-9     |                     |    |    |    |    |    |    |    |    |                 |
| Total   |                     | 1  | 8  | 16 | 6  | 1  |    |    |    | 32              |
| %       |                     |    |    |    |    |    |    |    |    |                 |

keep up. Now give me your best writing and spelling."

When the second hand of the watch reaches the sixty second mark, read all of the first sentence and tell the children to "write it." Wait until the second hand reaches the position shown by the figures in a parenthesis just before the second sentence, then read that sentence, and so on through the test, the children writing the sentences during the intervals between dictation.

At the conclusion of the test pass the answer cards and have the blanks in the first two lines filled out. Collect cards and papers.

In the fourth, sixth, and eighth grades give both the easy and the difficult words.

Discipline

# THE GARY PUBLIC SCHOOLS

## TEST PAPER

TEST  
= 93

May 9, 1914.

Grade 8B - 4th Class 4th

Name Dolores Breuninger

Age 12

- 1 The nation ought to get his money back.
- 2 He will occupy the seat of honor in the senate.
- 3 His agreement will entitle him to the reward.
- 4 Why hold the government responsible for the loss?
- 5 I am sure Wednesday will be a pleasant day.
- 6 The majority voted to organize a club.
- 7 Each minute seemed as long as a century.
- 8 Even a small piece will suit me greatly.
- 9 The plan you suggest calls for a serious study.
- 10 The expense of running the business was great.
- 11
- 12
- 13
- 14
- 15



# ANSWER AND RECORD CARD

The City Public School

FROEBEL

May 4<sup>th</sup>

Name Edwina Burroughs

Test 6 B

Age 13 Grades 6, 7, 8, 9 Class 46

Total Number of Words Missed

1  
95

Accuracy

Scored by \_\_\_\_\_

## Score Card—Spelling—Test 6 B

| Word        | No. | Check | Check | No. | Word     |
|-------------|-----|-------|-------|-----|----------|
| victim      | 1   |       |       | 11  | majority |
| ought       | 2   |       |       | 12  | organize |
| occupy      | 3   |       |       | 13  | minute   |
| senate      | 4   |       |       | 14  | century  |
| agreement   | 5   |       |       | 15  | piece    |
| entitle     | 6   |       |       | 16  | assist   |
| government  | 7   |       |       | 17  | suggest  |
| responsible | 8   |       |       | 18  | serious  |
| Wednesday   | 9   |       | X     | 19  | expense  |
| pleasant    | 10  |       |       | 20  | business |

Total Words Missed \_\_\_\_\_

Accuracy \_\_\_\_\_

# TABULATION SHEET

EMERSON

Class Record  
Sheet

Gary Public Schools

HANDWRITING

TEST 7

Examiner *T. -* Date *8-4-16* Name *S. H.*  
School *S. - Delano* Class No. *6-4-16* Grade *First*

| DICTATION TESTS       |                        |             | TEACHER'S SAMPLES |           |
|-----------------------|------------------------|-------------|-------------------|-----------|
| QUALITY, AYRES        | FREQUENCY              |             | QUALITY, AYRES    | FREQUENCY |
| 90                    | <i>Upper 7 Lower 1</i> |             | 90                | <i>8</i>  |
| 80                    |                        |             | 80                |           |
| 70                    | <i>1</i>               |             | 70                |           |
| 60                    | <i>3</i>               | <i>2</i>    | 60                | <i>1</i>  |
| 50                    | <i>3</i>               | <i>5</i>    | 50                | <i>7</i>  |
| 40                    | <i>15</i>              | <i>7</i>    | 40                | <i>14</i> |
| 30                    | <i>13</i>              | <i>19</i>   | 30                | <i>7</i>  |
| 20                    | <i>1</i>               | <i>3</i>    | 20                | <i>2</i>  |
| 10                    |                        |             | 10                |           |
|                       | <i>36</i>              | <i>36</i>   |                   | <i>31</i> |
| Median                | <i>72</i>              | <i>37.9</i> |                   | <i>45</i> |
| Per Cent 80 or Better |                        |             |                   | <i>44</i> |

*G. M. Kuning*

*O.K.  
R.*

## II. SPELLING

### LIST TEST

*Instructions.*—On entering a room, give the teacher an answer card for the test and tell her that as soon as the children are ready, you are going to ask her to dictate the words. Give her no further instructions. If she asks any questions about the giving of the test, tell her to follow her usual practice.

Then say to the children: "We are going to have a spelling test to-day. I am going to ask your teacher to dictate twenty words to you, and you will write them on these slips of paper."

Distribute the test papers and have the blanks filled out. Next ask the teacher to dictate the test words.

When she has finished, have the papers exchanged twice; then distribute the answer cards for the test and have the blanks filled out. Have the cards exchanged to correspond with the papers, and in the lower grades collect the cards and papers together. In the upper grades the papers are to be corrected by the children; each word being marked (x) or (c), (for wrong or right), the marks to be made on the cards, and not on the papers.

Collect the cards and papers together.

TEST PAPER  
The Gary Public Schools  
Test No. 6 A, Spelling

Name Dolores Bierwagen.

Age 13 Grade 8B Class 46

- 1 divide.
- 2 principle
- 3 testimony
- 4 discussion
- 5 arrangement
- 6 reference
- 7 evidence
- 8 organization
- 9 emergency
- 10 appreciate
- 11 sincerely
- 12 athletic
- 13 extrem
- 14 immediate
- 15 convenience
- 16 receipt
- 17 preliminary
- 18 decision
- 19 judgement.
- 20 recommend.

# ANSWER AND RECORD CARD

**FROEBEL**

The Gary Public Schools.

Name Dolores Bierwagen

Test 6 A

Boy or Girl

Age 13

Grade 8

Class 46

Total Number of Words Missed

7

Accuracy

62

Scored by \_\_\_\_\_

## Score Card—Spelling—Test 6 A

| Word         | No. | Check | Check | No. | Word                     |
|--------------|-----|-------|-------|-----|--------------------------|
| divide       | 1   | C     | X     | 11  | sincerely                |
| principal    | 2   | X     | C     | 12  | athletic                 |
| testimony    | 3   | C     | X     | 13  | extreme                  |
| discussion   | 4   | C     | X     | 14  | immediate                |
| arrangement  | 5   | C     | C     | 15  | convenience              |
| reference    | 6   | C     | C     | 16  | receipt                  |
| evidence     | 7   | C     | C     | 17  | preliminary <sup>1</sup> |
| organization | 8   | C     | C     | 18  | decision <sup>1</sup>    |
| emergency    | 9   | X     | X     | 19  | judgment                 |
| appreciate   | 10  | C     | X     | 20  | recommend                |

Total Words Missed 7

Accuracy \_\_\_\_\_

<sup>1</sup>Words 17 and 18 were marked correct when reference to page 495 shows that they were really misspelled. An illustration of imperfect scoring.

JEFFERSON

Class Record  
RecordGrade 8 A  
Gary Public Schools

#18

TEST 6

## SPELLING

Examiner R. Handberg Date 5-2-16 Home  
School 8 Class No. Grade

## LIST TEST

## NUMBER OF PUPILS FAILING ON

|          | Frequency | Misspelling |
|----------|-----------|-------------|
| 20 words |           |             |
| 19 "     |           |             |
| 18 "     |           |             |
| 17 "     |           |             |
| 16 "     | 1         | 16          |
| 15 "     | 1         | 15          |
| 14 "     | 1         | 14          |
| 13 "     | 1         | 13          |
| 12 "     | 1         | 12          |
| 11 "     | 1         | 11          |
| 10 "     | 2         | 20          |
| 9 "      |           |             |
| 8 "      | 3         | 24          |
| 7 "      | 1         | 7           |
| 6 "      | 5         | 30          |
| 5 "      | 2         | 10          |
| 4 "      | 2         | 8           |
| 3 "      | 3         | 9           |
| 2 "      | 2         | 4           |
| 1 "      | 5         | 5           |
| 0 "      | 2         |             |

Total 33 198

Average 6.0

Class Accuracy 70

Percent Perfect 60%

## DICTATION TEST

## NUMBER OF PUPILS FAILING ON

|          | Frequency | Misspelling |
|----------|-----------|-------------|
| 20 words |           |             |
| 19 "     |           |             |
| 18 "     |           |             |
| 17 "     |           |             |
| 16 "     |           |             |
| 15 "     |           |             |
| 14 "     | 1         | 14          |
| 13 "     |           |             |
| 12 "     | 1         | 12          |
| 11 "     | 1         | 11          |
| 10 "     | 1         | 10          |
| 9 "      |           |             |
| 8 "      | 3         | 24          |
| 7 "      | 1         | 7           |
| 6 "      | 1         | 6           |
| 5 "      | 1         | 5           |
| 4 "      | 2         | 8           |
| 3 "      | 3         | 9           |
| 2 "      | 5         | 10          |
| 1 "      | 5         | 5           |
| 0 "      | 8         |             |

Total 33 121

Average 3.6

Class Accuracy 82

Percent Perfect 24%

### III. ARITHMETIC

#### SERIES B (COURTIS)

*Instructions.*—On entering a room, ask the teacher for permission to give a test, and make sure that the children are provided with pencils.

Say: "We are going to have arithmetic tests this week. To-day we are to have addition and subtraction; to-morrow multiplication and division. Please do not turn these papers over (showing the two sides of the test) until we are ready."

Then distribute the papers. Have the blanks filled in. Read the instructions out loud before giving the warning signal: "Get Ready. Hands up"; then when the bell rings, "Start." Observe the time intervals given in the instructions and have the timing checked by the teacher.

Give the stopping signal by bell, but say also: "Stop. Hands up. Make a cross by the last example finished."

Distribute the score cards. Have the blanks filled in, writing the number of the class after "Grade." Have the papers and cards exchanged twice. Read the answers from the card, letting the children check the examples right (c) or wrong (x) on the score card in the column marked "Check." Part of an answer does not

count. Find the total number of the examples tried and the total right, writing these scores on the face of the card also.

Collect the cards by rows.

Have the papers exchanged again. Distribute new score cards, and again have the papers scored.

Collect both cards and papers by rows.

Pass the papers for the subtraction test. Have the blanks filled in and read the instructions out loud. Give the test as before.

Pass the score cards and have the blanks filled in, then collect both cards and papers.

#### SERIES B (CLEVELAND)

*Instructions.*—On entering a room say to the children: "We are to have an arithmetic test to-day. These papers contain five short tests. The first set of examples (point) is called set C; second, set H; the others, sets G, O, and L. Please do not look at any of these examples until we are ready. As soon as you get a copy of the tests, fill out blanks on cover.

Distribute the papers.

When I say: "Get ready," raise your pencil hand, take hold of cover with the other so you can open test quickly when I say: "Start." When I say: "Stop," close your papers and stand beside your desk. The first test is a test in the multiplication tables. It is called set C and comes at the top of the page. Write the answers on the paper directly underneath the examples.



## TEST PAPER

Illustration of form in which series B was used

|                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                       |                                                                                                                                                                                                                        |              |  |               |       |           |       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--|---------------|-------|-----------|-------|
|                                                                                                                                                                                                                                                                                       | <p><i>The Gary Public Schools</i></p> <p><b>Arithmetic Test No. 5 A. Addition.</b></p> <p><b>Series B. Form 3</b></p> | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2"><b>SCORE</b></td> </tr> <tr> <td>No. Attempted</td> <td>_____</td> </tr> <tr> <td>No. Right</td> <td>_____</td> </tr> </table> | <b>SCORE</b> |  | No. Attempted | _____ | No. Right | _____ |
| <b>SCORE</b>                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                       |                                                                                                                                                                                                                        |              |  |               |       |           |       |
| No. Attempted                                                                                                                                                                                                                                                                                                                                                          | _____                                                                                                                 |                                                                                                                                                                                                                        |              |  |               |       |           |       |
| No. Right                                                                                                                                                                                                                                                                                                                                                              | _____                                                                                                                 |                                                                                                                                                                                                                        |              |  |               |       |           |       |
| <p>You will be given eight minutes to find the answers to as many of these addition examples as possible. Write the answers on this paper directly underneath the examples. You are not expected to be able to do them all. You will be marked for both speed and accuracy, but it is more important to have your answers right than to try a great many examples.</p> |                                                                                                                       |                                                                                                                                                                                                                        |              |  |               |       |           |       |
| <p>Name <u>Raymond Little Boy</u> <span style="float: right;">DATE</span></p> <p>Age <u>12 yrs</u> Grade <u>8A-B</u> Hour <u>10:20</u></p>                                                                                                                                                                                                                             |                                                                                                                       |                                                                                                                                                                                                                        |              |  |               |       |           |       |

# APPENDIX B

501

|                                   |     |     |     |     |     |     |     |
|-----------------------------------|-----|-----|-----|-----|-----|-----|-----|
| 339                               | 799 | 952 | 937 | 489 | 789 | 872 | 309 |
| 276                               | 584 | 397 | 274 | 877 | 555 | 657 | 964 |
| 977                               | 135 | 535 | 468 | 482 | 342 | 329 | 673 |
| 861                               | 647 | 669 | 836 | 645 | 908 | 794 | 437 |
| 757                               | 624 | 386 | 323 | 761 | 471 | 563 | 338 |
| 698                               | 512 | 974 | 485 | 598 | 896 | 128 | 591 |
| 269                               | 146 | 458 | 357 | 352 | 123 | 856 | 636 |
| 136                               | 699 | 702 | 925 | 431 | 637 | 962 | 704 |
| 322                               | 109 | 397 | 819 | 367 | 254 | 287 | 119 |
| 4635/425507605274992-497557784771 |     |     |     |     |     |     |     |
| 125                               | 473 | 782 | 485 | 781 | 602 | 761 | 656 |
| 767                               | 318 | 403 | 539 | 945 | 770 | 978 | 282 |
| 632                               | 272 | 555 | 285 | 574 | 358 | 820 | 878 |
| 306                               | 857 | 688 | 147 | 497 | 625 | 747 | 390 |
| 290                               | 425 | 349 | 875 | 926 | 348 | 504 | 614 |
| 949                               | 693 | 814 | 387 | 832 | 584 | 939 | 563 |
| 883                               | 469 | 397 | 126 | 668 | 992 | 485 | 207 |
| 418                               | 954 | 966 | 604 | 303 | 645 | 268 | 791 |
| 574                               | 346 | 329 | 418 | 729 | 377 | 356 | 138 |
| 49444807                          |     |     |     |     |     |     |     |
| 595                               | 399 | 907 | 735 | 246 | 356 | 250 | 845 |
| 303                               | 275 | 293 | 354 | 357 | 409 | 707 | 372 |
| 587                               | 583 | 468 | 512 | 400 | 970 | 442 | 689 |
| 281                               | 777 | 272 | 695 | 579 | 648 | 991 | 835 |
| 776                               | 841 | 753 | 849 | 782 | 593 | 697 | 426 |
| 642                               | 656 | 836 | 402 | 691 | 861 | 754 | 745 |
| 624                               | 924 | 969 | 987 | 968 | 938 | 836 | 813 |
| 958                               | 365 | 637 | 298 | 834 | 223 | 788 | 197 |
| 139                               | 463 | 293 | 128 | 125 | 555 | 177 | 686 |

Back of test paper

# ANSWER AND RECORD CARD

JEFFERSON

Name Raymond Little, Boy Test No. 5, A

Boy or Girl Age 12 Grade 8A 18

Scores. Number Tried 10

Number Right 7

Accuracy 70

The Gary Public Schools.

## Answers to Test 5, A

| Answer | No. | Check | Check | No. | Answer |
|--------|-----|-------|-------|-----|--------|
| 4635   | 1   | C     |       | 13  | 6255   |
| 4255   | 2   | C     |       | 14  | 5301   |
| 5470   | 3   | X     |       | 15  | 5858   |
| 5424   | 4   | X     |       | 16  | 4519   |
| 5002   | 5   | X     |       | 17  | 4905   |
| 4975   | 6   | C     |       | 18  | 5283   |
| 5448   | 7   | C     |       | 19  | 5428   |
| 4771   | 8   | C     |       | 20  | 4960   |
| 4944   | 9   | C     |       | 21  | 4982   |
| 4807   | 10  | C     |       | 22  | 5553   |
| 5283   | 11  |       |       | 23  | 5642   |
| 3866   | 12  |       |       | 24  | 5608   |

Total Tried \_\_\_\_\_ Total Right \_\_\_\_\_

# TABULATION SHEET

JENKINSON *Grade 8 A*  
 Class Gary Public Schools  
 Record Sheet  
 Arithmetic  
 Examiner  
 Operator

#17  
 TEST 6

## ARITHMETIC

Score Speed *102* Accuracy *64.5* Efficiency *0*  
*102*

| PER CENT. OF ACCURACY |     |       |       |       |       |       |       | Frequency |
|-----------------------|-----|-------|-------|-------|-------|-------|-------|-----------|
| SPEED                 | 100 | 90    | 80    | 70    | 60    | 50    | 40-0  | Speed     |
| 24                    |     | 12-32 | 13-21 | 14-10 | 15-00 | 16-14 | 17-11 |           |
| 23                    |     | 11-00 | 12-00 | 13-10 | 14-10 | 15-10 | 16-11 |           |
| 22                    |     | 10-01 | 11-10 | 12-17 | 13-15 | 14-10 | 15-10 |           |
| 21                    |     | 10-00 | 11-10 | 12-10 | 13-14 | 14-10 | 15-10 |           |
| 20                    |     | 10-10 | 11-17 | 12-15 | 13-10 | 14-11 | 15-0  |           |
| 19                    |     | 10    | 11-17 | 12-15 | 13-10 | 14-11 | 15-0  |           |
| 18                    |     | 17    | 12-10 | 13-14 | 14-10 | 15-10 | 16-0  |           |
| 17                    |     | 10    | 11-10 | 12-10 | 13    | 14-10 | 15-0  |           |
| 16                    |     | 10    | 11-14 | 12    | 13-11 | 14-0  | 15-0  |           |
| 15                    |     | 14    | 12-10 | 13    | 14-10 | 15    | 16-0  | 1         |
| 14                    |     | 13    | 12    | 13-11 | 14-0  | 15    | 16-0  |           |
| 13                    |     | 12    | 11    | 12    | 13-0  | 14    | 15-0  | 2         |
| 12                    |     | 11    | 10    | 11    | 12-0  | 13    | 14-0  | 5         |
| 11                    |     | 10    | 9     | 10    | 11-0  | 12    | 13-0  | 40        |
| 10                    |     | 9     | 8     | 9     | 10-0  | 11    | 12-0  | 6         |
| 9                     |     | 8     | 7     | 8     | 9-0   | 10    | 11-0  | 4         |
| 8                     |     | 7     | 6     | 7     | 8-0   | 9     | 10-0  | 6         |
| 7                     |     | 6     | 5     | 6     | 7-0   | 8     | 9-0   | 1         |
| 6                     |     | 5     | 4     | 5     | 6-0   | 7     | 8-0   |           |
| 5                     |     | 4     | 3     | 4     | 5-0   | 6     | 7-0   | 1         |
| 4                     |     | 3     | 2     | 3     | 4-0   | 5     | 6-0   | 2         |
| 3                     |     | 2     | 1     | 2     | 3-0   | 4     | 5-0   |           |
| 2                     |     | 1     | 0     | 1     | 2-0   | 3     | 4-0   |           |
| 1                     |     | 0     | 0     | 0     | 1-0   | 2     | 3-0   |           |
| 0                     |     | 0     | 0     | 0     | 0     | 1     | 2     |           |
| Total                 | 2   | 1     | 2     | 5     | 11    | 2     | 9     | 32        |

% *69* *34* *100* *150* *340* *69* *280*

Median Score - Speed *12* Accuracy *64.5* Efficiency

*E. M. Carter*

Now lay your pencils down while we practice starting—"Get ready, start, stop, close papers, stand."

When all understand, give the first test, warning the children to *multiply* just before giving the signal: "Get ready." Have children put a circle around the last problem completed when they stop.

While the children are standing, say: "The next set of examples, Set H, on the lower half of this page, contains easy examples in the addition and subtraction of fractions. Watch the signs and do what they tell you to do. If you cannot work these examples, close your papers and wait for the next test."

Give the test.

For the next test, say: "Set G is another multiplication test. Write your answers directly underneath the examples.

Give the test.

The next test, Set O, on lower half of cover page, is made up of examples in addition, subtraction, multiplication, and division of fractions. Watch the signs and do what they tell you to do.

Give the test.

Set L, the last test, is on the back of the paper, and is a test in long multiplication.

Give the test.

Distribute cards, one set at a time, and have blanks filled out. Then place all cards inside folder. Collect in grades three and four. In other grades exchange twice and score in this order: L, G, and C as far as time permits.

TEST PAPER

**The Gary Public Schools**  
Arithmetic Tests  
Individual Score Sheet

John J. Jones      100  
100      100      100      100      100

Score in Number of Examples

|             |             |             |
|-------------|-------------|-------------|
| Set A       | Set B       | Set C       |
| Read _____  | Read _____  | Read _____  |
| Write _____ | Write _____ | Write _____ |

Set D      Set E

|             |             |
|-------------|-------------|
| Read _____  | Read _____  |
| Write _____ | Write _____ |

Instructions for Children

1. Copy promptly all digits from the examples, who will not give when to begin practice and when to stop.

2. Do all your work directly on this paper. Work neatly and rapidly, but do not hurry. Copy the answers the one right will be accepted.

SET C - Multiplication

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

Set D - Multiplication

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

SET E - Multiplication

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

SET F - Multiplication

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

SET G - Multiplication

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |

Work Examples

Set A \_\_\_\_\_ 20 minutes  
Set B \_\_\_\_\_ 20 minutes  
Set C \_\_\_\_\_ 1 minute  
Set D \_\_\_\_\_ 2 minutes  
Set E \_\_\_\_\_ 2 minutes

## ANSWER AND RECORD CARD

Name Lisle Sanders Test No. 11, CBoy or Girl Age 14 Grade 8a Class 18Scores. Number Tried 23Number Right 20Accuracy           

The Gary Public Schools.

## Answers for Test 11, C

|   |    |    |   |    |   |    |    |    |    |
|---|----|----|---|----|---|----|----|----|----|
| 6 | 28 | 72 | 0 | 30 | 4 | 18 | 42 | 0  | 45 |
| C | C  | C  | X | C  | C | C  | C  | X  | C  |
| 9 | 10 | 32 | 0 | 30 | 2 | 9  | 54 | 0  | 28 |
| C | C  | C  | X | C  | C | C  | C  | C  | C  |
| 6 | 16 | 49 | 0 | 24 | 7 | 24 | 81 | 0  | 12 |
| C | C  | C  |   |    |   |    |    |    |    |
| 5 | 16 | 72 | 0 | 20 | 4 | 12 | 64 | 0  | 27 |
|   |    |    |   |    |   |    |    |    |    |
| 7 | 12 | 48 | 0 | 27 | 4 | 18 | 63 | 25 | 24 |
|   |    |    |   |    |   |    |    |    |    |

Total Tried 23 Total Right 20

# TABULATION SHEET

Class  
Record  
Sheet  
Examiner  
Operation

Gary Public Schools

ARITHMETIC

#14  
TEST

11C

Asabaugh Date 5-18-16 Name

Class No.

Grade

Score - Speed

41.66

Accuracy

91.8

Efficiency

—

PER CENT OF ACCURACY

| SPEED | 100   | 90    | 80    | 70    | 60    | 50    | 40-0  | Frequency<br>Speed |
|-------|-------|-------|-------|-------|-------|-------|-------|--------------------|
| 24    | 32-33 | 30-31 | 27-29 | 25-26 | 23-24 | 21-22 | 19-20 | 1NF-1              |
| 23    | 27-32 | 26-30 | 27-28 | 24-25 | 22-23 | 20-21 | 18-19 | 1                  |
| 22    | 20-31 | 20-29 | 20-29 | 24-25 | 21-22 | 19-20 | 17-18 | 1                  |
| 21    | 19-30 | 27-28 | 25-26 | 23-24 | 21-22 | 19-20 | 17-18 | 1                  |
| 20    | 18-29 | 24-27 | 24-25 | 23-23 | 20-21 | 19-20 | 17-18 | 1                  |
| 19    | 18    | 20-27 | 24-25 | 23-23 | 20-21 | 19-20 | 17-18 | 3                  |
| 18    | 17    | 15-26 | 18-24 | 21-22 | 20-20 | 19-20 | 17-18 | 1                  |
| 17    | 2     | 10    | 24-28 | 20-20 | 21    | 20-20 | 19-20 | 7                  |
| 16    | 1     | 16    | 20-24 | 23    | 20-21 | 19-20 | 17-18 | 1                  |
| 15    | 1     | 14    | 23-25 | 21    | 20-20 | 19    | 17-18 | 2 16               |
| 14    | 1     | 13    | 20    | 20-21 | 19    | 19    | 17-18 | 3 16               |
| 13    | 1     | 11    | 20    | 20    | 19    | 19    | 17-18 | 5                  |
| 12    | 1     | 11    | 20    | 20    | 19    | 19    | 17-18 | 3                  |
| 11    | 2     | 10    | 20    | 20    | 19    | 19    | 17-18 | 4                  |
| 10    | 0     | 4     | 20    | 20    | 19    | 19    | 17-18 | 1                  |
| 9     | 0     | 0     | 20    | 20    | 19    | 19    | 17-18 | 0                  |
| 8     | 0     | 0     | 20    | 20    | 19    | 19    | 17-18 | 0                  |
| 7     | 0     | 0     | 20    | 20    | 19    | 19    | 17-18 | 0                  |
| 6     | 0     | 0     | 20    | 20    | 19    | 19    | 17-18 | 0                  |
| 5     | 0     | 0     | 20    | 20    | 19    | 19    | 17-18 | 0                  |
| 4     | 0     | 0     | 20    | 20    | 19    | 19    | 17-18 | 0                  |
| 3     | 0     | 0     | 20    | 20    | 19    | 19    | 17-18 | 0                  |
| 2     | 0     | 0     | 20    | 20    | 19    | 19    | 17-18 | 0                  |
| 1     | 0     | 0     | 20    | 20    | 19    | 19    | 17-18 | 0                  |
| 0     | 0     | 0     | 20    | 20    | 19    | 19    | 17-18 | 0                  |
| Total | 80    | 11    | 90    | 2     | 1     | 2     | 34    | 0                  |
| %     |       |       |       |       |       |       |       |                    |

Median Score - Speed

Accuracy

Efficiency

C. J. Jones



#### IV. COMPOSITION

*Instructions.*—Give list of subjects to teacher to write on board.

Say to the children: "I want to find out to-day what kind of a composition you can write. I am going to ask you to write a story about an interesting experience that you or your friend may have had sometime or other. These are to be your own stories; nothing that you have just read somewhere or seen at a moving picture theatre. A real story will probably be best, but if you cannot write a real story, you may make up one of your own. Make it as interesting or as exciting as you can. Your teacher has written some suggestions on the board to help if you cannot think of anything yourself." Read them.

An Interesting Experience.

A Storm.

An Accident.

A Runaway.

An Errand at Night.

An Unexpected Meeting.

On the Ice.

In the Woods.

On the Water.

In the Mountains.

"However, you do not have to use any of these subjects unless you want to. Will those in the front seats please distribute the papers for me?"

Fill in the blanks.

"I am going to ask you to start together. You may spend the first few minutes thinking of what you are going to say, if you wish. I shall give you about twenty minutes in which to write your story. If you need more paper than the sheet which you have, raise your hand and I will bring you another. If you should finish your story before the time is up, please let me know by raising your hand."

Start—allow twenty minutes—stop.

Have children count words written.

| ANSWER AND RECORD CARD     |                 |                     |                 |
|----------------------------|-----------------|---------------------|-----------------|
| EMERSON                    |                 | COMPOSITION. Test 8 |                 |
| Name <u>Camer, Ruth</u>    |                 | No. <u>20</u>       |                 |
| Age <u>73</u>              | Grade <u>8A</u> | Class <u>14</u>     | Box or Girl     |
|                            |                 |                     | P. E. Ratio     |
| 1. Number of words written | <u>181</u>      | Rate                | <u>11.2/min</u> |
| 2. Vocabulary              | <u>99</u>       | Coefficient         | <u>55</u>       |
| 3. Spelling                | <u>0-2</u>      | "                   | <u>0-11</u>     |
| 4. Capitalization          | <u>0</u>        | "                   |                 |
| 5. Punctuation             | <u>0</u>        | "                   |                 |
| 6. Grammar                 | <u>2</u>        | "                   |                 |
| 7. Time <u>16' 15"</u>     | Sample          | Hillegas            | <u>50</u>       |



VOCABULARY ANALYSIS SHEET  
THE GARY SURVEY

VOCABULARY

School Emerson Class 14  
Name Ruth Comer Grade 89

| Total |     |     | Different |    |   |
|-------|-----|-----|-----------|----|---|
| S     | 24* | 13* | For       |    |   |
| A     | 23  | 10  |           |    |   |
| C     | 6   | 4   | O         | 10 | 5 |
| F     | 1   | 1   | I         | 13 | 3 |
| T     | 28  | 11  | N         | 3  | 3 |
| P     | 7   | 7   | G         | 7  | 7 |
| B     | 4   | 4   | U         | 0  | 0 |
| W     | 10  | 6   | V         | 0  | 0 |
| D     | 4   | 3   | Y         | 1  | 1 |
| R     | 7   | 5   | J         | 2  | 1 |
| E     | 3   | 3   | K         | 0  | 0 |
| M     | 18  | 5   | Q         | 0  | 0 |
| H     | 10  | 5   | Z         | 0  | 0 |
| L     | 3   | 2   | X         | 1  | 0 |
| TOTAL |     |     | 181 99    |    |   |

% 55%

\*Summary of records on page 512.



# TABULATION SHEET

Class  
Record  
Sheet

89- Gary Public Schools

#45 TEST 8

## COMPOSITION

School \_\_\_\_\_ Class No. 89 Grade #45

Score—Speed 145 Quality 40 Efficiency \_\_\_\_\_

| QUALITY MILLEGAS SCALE |    |    |     |    |    |    |    |    |    |                    |
|------------------------|----|----|-----|----|----|----|----|----|----|--------------------|
| SPEED                  | 10 | 20 | 30  | 40 | 50 | 60 | 70 | 80 | 90 | Frequency<br>Speed |
| 30-39                  |    |    |     |    |    |    |    |    |    |                    |
| 25-29                  |    |    |     |    |    |    |    |    |    |                    |
| 24                     |    |    |     |    |    |    |    |    |    |                    |
| 23                     |    |    |     |    |    |    |    |    |    |                    |
| 22                     |    |    |     |    |    |    |    |    |    |                    |
| 21                     |    |    |     |    |    |    |    |    |    |                    |
| 20                     |    |    |     |    |    |    |    |    |    |                    |
| 19                     |    |    | 1   |    |    |    |    |    |    | 1                  |
| 18                     |    |    | 1   |    |    |    |    |    |    | 1                  |
| 17                     |    |    |     |    |    |    |    |    |    |                    |
| 16                     |    |    | 1   |    |    |    |    |    |    | 1                  |
| 15                     |    |    |     | 2  |    |    |    |    |    | 2                  |
| 14                     |    |    | 1   |    | 1  |    |    |    |    | 2                  |
| 13                     |    |    | 2   |    |    |    |    |    |    | 2 <sup>⑥</sup>     |
| 12                     |    |    |     | 1  |    |    |    |    |    | 1                  |
| 11                     |    |    |     | 2  |    |    |    |    |    | 1                  |
| 10                     |    |    | 1   |    |    |    |    |    |    | 1                  |
| 9                      |    |    |     |    |    |    |    |    |    |                    |
| 8                      |    |    |     |    |    |    |    |    |    |                    |
| 7                      |    |    |     |    |    |    |    |    |    |                    |
| 6                      |    |    |     |    |    |    |    |    |    |                    |
| 5                      |    |    |     |    |    |    |    |    |    |                    |
| 4                      |    |    |     |    |    |    |    |    |    |                    |
| 3                      |    |    |     |    |    |    |    |    |    |                    |
| 2                      |    |    |     |    |    |    |    |    |    |                    |
| 1                      |    |    |     |    |    |    |    |    |    |                    |
| 0                      |    |    |     |    |    |    |    |    |    |                    |
| ⑤ Total                |    |    | 7.5 | 1  |    |    |    |    |    | 13 <sup>⑥</sup>    |

RB. Md. 40

## V. READING

### GRAY'S ORAL READING SCALE

*Instructions.*—Find as quiet a place as possible to give the tests; arrange with the teacher to send one pupil to the door of this room every seven minutes. When you are ready to begin, hand the pupil a copy of the test and give the following directions:

"I have here some paragraphs which I should like to have you read for me. Read at your natural rate, as you read for your teacher in class. Begin at the first paragraph when I say 'Begin.' Stop at the end of each paragraph until I say: 'Next.' When you have finished a paragraph hold the paper at your side until I ask you to read the next. If you should find some hard words, read them as well as you can without help and continue reading."

### SUGGESTIONS

A mispronunciation that is evidently due to a foreign accent is not to be counted as an error. However, indicate the foreign accent at the top of the page.

In general, there are six types of errors; gross errors, minor errors, substitutions, insertions, omissions, and repetitions. When two errors occur in a single word or

phrase, only one error—the last—should be counted. (For instance, a mispronunciation and a repetition.)

A single word repeated once is not counted a repetition, but if it is repeated more than once it is a repetition.

Watch for the substitution, insertion, or omission of letters as well as of words and syllables.

Keep time to the nearest seconds only.

Place each pupil under each of the following categories: Expression: No expression (N. E.), mechanical (M. E.), intelligent (I. E.). Type of reading: Word (W), sentence (S), paragraph (P).

#### REPRODUCTION TEST

*Instruction.*—The Reading and Reproduction Tests are to be given as follows: "Little Baby Bear" in grades two, three, four, and five; "Nothing on the Breakfast Table," in grades five, six, seven, and eight; "An Accident" in grades eight, nine, ten, eleven, and twelve; "Two Ways of Asking a Favor" in grades four, five, six, seven, and eight.

In second grade classes no attempt need be made to have the children reproduce the story, if in the judgment of the teacher they lack ability to write connected sentences.

Time allowance for "Little Baby Bear" is one minute for second and third grades, thirty seconds for fourth and fifth grades; for "Nothing on the Breakfast Table" one minute; for "An Accident," one minute; and for "Two Ways of Asking a Favor," forty five seconds.



# ANSWER AND RECORD CARD

EMERSON

## GRAY'S ORAL READING TEST

Name Raffaport Louis Test No. 12

Boy ☒ Girl ☐ Age 12 Grade 8A Class 14

Ability, Standard 1 10 Standard 4 8

Rate of Reading \_\_\_\_\_ Points 41

The Gary Public Schools

## GRAY'S READING SCALE

| No. | Time | Errors | St'd | Value | Product |
|-----|------|--------|------|-------|---------|
| 1   | 12   | 0      | 4    |       | 20      |
| 2   | 13   | 1      | 4    | 5     | 20      |
| 3   | 14   | 1      | 4    | 5     | 20      |
| 4   | 19   | 1      | 4    | 5     | 20      |
| 5   | 19   | 0      | 4    | 5     | 20      |
| 6   | 16   | 1      | 4    | 5     | 20      |
| 7   | 20   | 2      | 3    | 5     | 15      |
| 8   | 22   | 0      | 4    | 5     | 20      |
| 9   | 24   | 5      | 1    | 5     | 5       |
| 10  | 33   | 4      | 1    | 5     | 5       |
| 11  | 20   | 7      | 0    | 10    |         |
| 12  |      |        |      | 5     |         |

Grade Values for 4 165

Paragraph 1 Score 41

I. 55 V. 20  
 II. 35 VI. 15  
 III. 30 VII. 10  
 IV. 25 VIII. 5

30

# TABULATION SHEET

This sheet was designed for test in copying figures, but was used for tabulating scores in oral reading

FROEBEL

Grade 8a, #43

Test No. 12  
Rate of Work

The Gary Public Schools

Class Sheet

Teacher: Hogan, All  
School: Latham, Arden

Grade

Date: 5-21-26 Hour

| Trial hastened |              |               |               | Trial  |              |               |               |
|----------------|--------------|---------------|---------------|--------|--------------|---------------|---------------|
| SCORE          | Boys<br>Fig. | Girls<br>Fig. | TOTAL<br>Fig. | SCORE  | Boys<br>Fig. | Girls<br>Fig. | TOTAL<br>Fig. |
| OVER           |              |               |               | OVER   | total        |               | av            |
| 160            |              |               |               | 160    | 45           | 5             | 11            |
| 150            |              |               |               | 150    | 90           | 5             | 23            |
| 140            |              |               |               | 140    | 135          | 2             | 34            |
| 130            |              |               |               | 130    | 140          | 5             | 35            |
| 120            | 1            |               |               | 120    | 145          | 2             | 36            |
| 110            | 5            |               |               | 110    | 150          | 2             | 38            |
| 100            |              |               |               | 100    | 155          | 2             | 39            |
| 90             | 20           |               |               | 90     | 185          | 2             | 46            |
| 80             |              | 50            |               | 80     | 190          | 2             | 48            |
| 70             | 1            |               |               | 70     | 235          | 2             | 59            |
| 60             |              | 10            |               | 60     |              |               |               |
| 50             |              | 2             |               | 50     |              |               |               |
| 40             | 1            |               |               | 40     |              |               |               |
| 30             |              | 1             |               | 30     |              |               |               |
| 20             |              |               |               | 20     |              |               |               |
| 10             |              | 1             |               | 10     |              |               |               |
| 0              |              |               |               | 0      |              |               |               |
| Total          | 110          | 100           |               | Total  | 1470         |               |               |
| Median         | 112          | 7             |               | Median | 36.7         |               | 37            |
|                | 1.018        |               |               |        |              |               |               |

Possible errors: Scoring

Tabulating

Miscellaneous

Actual errors: Scoring

Tabulating

Miscellaneous

Answer

R. Evans

On entering a room, say: "I have a reading test for you to-day. I am going to ask you to read a story for me, and will give each of you a copy of these papers, but you are not to look on the inside pages until I tell you to do so."

Have the papers passed by the boys and girls in the front seats. When all are supplied, have the blanks at the top of the sheet filled out and the instructions read out loud.

Say: "These instructions mean that when I say 'Start' you are to read out loud with me the title and everything that is printed on this front page (pointing). When I say: 'Turn,' you are to turn the page and read the rest of the story to yourself. You should read only as rapidly as you can understand what you read, for when you finish I am going to ask you to turn to the last page (illustrating) and write in your own words as much of the story as you can remember. When I say: 'Stop' I am also going to say: 'Draw a line around the last word read.' That means that if you are reading a word in the middle of a sentence, for instance, you are to draw a line around it like this (illustrating on board or test paper), to show me just where you stopped. Now we are ready to try it."

Say: "Start" and begin to read the title and story. At the bottom of the first page say: "Turn" and start the stop-watch. Exactly the proper number of seconds later say "Stop. Draw a line around the last word read; turn to the last page and begin to write as much as

you can remember of the story you have just read." Start the stop-watch again; exactly three minutes later say: "Stop. Put a cross on the paper after the last word written and go on writing." At the end of five minutes say: "Stop."

Collect the papers.

Where a class takes two or three of the tests they are to be given in succession in the same class period.

#### KANSAS SILENT READING TEST

*Instructions.*—On entering a room, say to the teacher: "May I test this class this hour?" Upon receiving permission, make sure the class is the one called for on your schedule.

Have the children clear their desks, and make sure each is supplied with a sharp pencil.

When all are ready, say: "I am going to give you a new test to-day. This has instructions on the front (holding paper up for inspection), questions on the inside pages (opening the test), and on the back. Please do not open the papers or look at the questions until I give you the proper signal."

Distribute the papers.

Have the children fill in name, age, grade—only.

Read the instructions out loud with the children, having them actually draw a line around the word "cow" at the point where the instructions say to draw the line.

For grades three to eight the time interval is to be five minutes. For grades nine to twelve the time interval is

# Test Sheets

**The Gray Public Schools  
First Reading Test No. 1  
Reading and Reproduction  
For Grade 4, 4, 4, 9**

[illegible]

**A Little Baby Bear.**

Not long ago I had a queer little visitation. It was a tiny baby bear. A hunter had caught him in the woods and brought him to town in his arms. As soon as I saw him, I asked the hunter

He was very cunning. I wish you would have seen him tripping about on his hind feet with a tiny yellow orange in his hand. He hugged it tight against his arm. He hugged it tight against his breast and bit it with his wet baby teeth. But I did not see his tongue until I gave him a licking glass. The moment he saw me the other baby bent, a pint tongue, and a curled root-let, came out and I kissed the little bear in the bright glass.

128 *troughs. When he saw it, he reached*  
 129 *down and cried for it, just as a hungry baby*  
 130 *does. He stood up and took the bottle*  
 131 *out of his hand and took the bottle*  
 132 *up and sucked away so fast that soon*  
 133 *it was empty and he was left with*  
 134 *where it was all gone. When he saw*  
 135 *the black coat-drove and wiped off his milky*  
 136 *mouth.*

137 *I played with my queer little visitor*  
 138 *all afternoon, and when I took him home*  
 139 *it was past four bedtime. He was glad*  
 140 *to go to bed, and was soon curled up*  
 141 *in a little woolly ball, fast asleep.*

142 *Charlotte's Web*

**On this page represent in your own words in detail a**

as I thought it little  
leaves the thought kind to them  
I wanted to see how things  
X's & Y's could not be worth like  
any paper, but as looking glass  
has been written in the house  
and others to young kind  
the little has that way, the little  
looking glass, I saw for the  
first time, I saw it, I saw it  
for some 5 years, the little  
looking glass, I saw it, I saw it

The form for the other reproduction test was the same as in Test No. 1.  
The contents of the other tests were as follows:

*Test 2—*

**NOTHING ON THE BREAKFAST TABLE**

Fred came down late to breakfast one morning, so late that all the other members of the family were through, and had gone about their respective duties. But though he had slept late, Fred was still sleepy; for he had staid up until twelve o'clock the night before, whereas he was usually in bed by nine. To tell the truth, he was also rather cross,—as most boys are apt to be when they are sleepy,—and as he took his seat, he said: "Pshaw! there's nothing on the breakfast table."

Then he called loudly, "Kate, Kate." But no Kate replied,—for the excellent reason that she didn't hear him. She was out in the poultry yard feeding the chickens. So Fred leaned forward with a very discontented expression on his face, and closed his eyes; but he soon opened them again, and began to sneeze. A pungent odor had tickled his nose.

"*Ker-chew! ker-chew! ker-chew!* What in the world did that?" said he.

"*I did,*" replied a sharp little voice, and there on the table before him stood a small creature dressed in green and wearing the brightest of red caps.

"And who are you?" asked Fred.

"I'm Pepper. Nothing on the breakfast table, hey? I call it decidedly ungrateful of you to say that, when there are a number of things here brought from all parts of the world to serve you. I, for instance, came wry from the East Indies to help season your food. One would suppose then you would be somewhat obliged to me, and would not count me as nothing."

"That's true," joined in a second small voice, and another small figure, wearing a pure white dress dotted with shining crystals, and a wreath of what seemed to be baby-snowflakes, sprang from the glass salt cellar.

"And who are you?" said Fred.

"I am Salt," came the answer in clear tones. "I have come from deep mines and deep waters to wait upon you. What you would do without me I do not know; for you require my aid morning, noon and night. Am I then to be counted as nothing?"

"And am I nothing?" asked another tiny form that stepped from the bread plate and bowed gracefully. "I am Wheat, and you have me to thank for Bread, which one of your wise men has said is the staff of life."

"And how about me?" called the sweetest voice of all from the top of the syrup jug, where sat a brown-faced elf in a suit like jointed armor, a *flayer* in one hand, a greenish stick in the other. "I belong to sugar cane and I come from the West Indies to give you syrup for your griddle cakes and sugar for your coffee."

"And we," spoke two more quiet wee creatures in the same breath, as they peeped from behind the coffee pot, "have travelled from Java and Arabia to bring you pleasure."

"I didn't mean—" Fred started to make reply, but suddenly his little visitors had disappeared and Kate was bringing in his breakfast; crisp slices of buttered toast, a plate of delicious wheat cakes with golden syrup, and a cup of steaming coffee. "Oh," said Fred, "how much there is on the breakfast table after all!"

—and How to Write

## SILENT READING

### Just a The Accident.

I had not walked far into the country, before I found work in Brown's brickyard at \$22 a month and board. It was my task to cart clay in the afternoon to fill up the "pits" which had been emptied during the morning. It was an idle enough kind of job. All I had to do was to walk alongside my horse, a big white beast with no joints at all except where its legs were hinged to the backbone, back it up to the pit, and dump the load. But, walking so in the autumn sun, I fell adreaming. I forgot claybank and pit; I was back in the old town,—saw my sweetheart play among the timber. I met her again on the Long Bridge. I held her hands once more in that last meeting—the while I was mechanically backing my load up to the pit and making ready to dump it. Daydreams are out of place in a brickyard. I forgot to take out the tail-board. To my amazement, I beheld the old horse skating around, making frantic efforts to keep its grip on the soil, then slowly rise before my bewildered gaze, clawing feebly at the air as it went up and over, backwards into the pit, load, cart and all.

I wish for my own reputation that I could truly say I wept for the poor beast. I am sure I felt for it, but the reproachful look it gave me as it lay there on its back, its four feet pointing skyward, was too much. I sat upon the edge of the pit and shouted with laughter, feeling thoroughly ashamed of my levity. Mr. Brown himself checked it, running in with his two sons and demanding to know what I was doing. They had seen the accident from the office, and at once set about getting the horse out. That was no easy matter. It was not hurt at all, but it had fallen so as to bend one of the shafts of the truck like a bow. It had to be sawed in two to get the horse out. When that was done, the heavy ash stick, rebounding suddenly, struck one of the boys who stood by a blow on the head that laid him out senseless beside the cart.

It was no time for laughter then. We ran for water and restoratives, and brought him to, white and weak. The horse by that time had been lifted to his feet and stood trembling in every limb, ready to drop. It was a sobered driver that climbed out of the pit at the tail end of the procession which bore young Brown home. I spent a miserable hour hanging around the door of the house waiting for news of him. In the end his father came out to comfort me with the assurance that he would be all right. I was not even discharged, though I was deposed from the wagon to the command of a truck of which I was myself the horse. I "ran out" brick from the pit after that in the morning.

(Adapted from "The Making of an American," by Jacob Viner)

## SILENT READING

### Test 4

#### TWO WAYS OF ASKING A FAVOR

The lion-tamer stood leaning against one of his cages. As the two young officers came up to him, he folded his arms and watched them idly. Duke Alexander looked him over carefully before he spoke; but Prince Michael began curtly:

"Are you Romanoff, the lion-tamer?"

Romanoff nodded. "Yes," he said, quietly

"I am Prince Michael of the Emperor's Guard. The Grand Duke orders you to come to-morrow to his place."

Romanoff looked at him from under his long lashes. "What is the Grand Duke to me," he said, "or what am I to him? I am here to look after my lions."

Prince Michael's face flushed scarlet and the hot blood mounted to his eyes. He took a step forward, but his cousin pulled at his arm.

"You are quite in the wrong, Michael," he said. "That is no way to ask a favor. Go over there while I speak with him."

Michael walked over to the entrance of the tent and waited sullenly; but the young Duke looking at Romanoff, said: "Do not mind him. He is only a great school-boy. It is not the Grand Duke who wants you. It is my sister, the little Duchess Vera. She is very lame and walks on crutches. She suffers a great deal. She came to the circus to-day, and saw you; and now she wants you to come and tell her all about the lions. Set your own price. Whatever your time is worth, I will pay you. I can refuse her nothing."

A pleasant smile lighted up Romanoff's dark face, showing his firm white teeth, and the kindly lines in the corners of his mouth.

"What my time is worth is my own affair," he said. "You could not pay me for going; but if the little lady is lame and ill, and wants me, I will go gladly."

(Adapted from St. Michael)



| ANSWER AND RECORD CARD                                                                                               |               |          |                      |
|----------------------------------------------------------------------------------------------------------------------|---------------|----------|----------------------|
| Silent Reading Test No. 1                                                                                            |               |          | EMERSON <sup>9</sup> |
| Name                                                                                                                 | Edna Vallette |          | Test No. 13          |
| <del>Age</del><br>Girl                                                                                               | Age 15        | Grade 8a | Class 14             |
| Number of Words Read                                                                                                 |               | 191      | 153                  |
| Rate                                                                                                                 |               | 190      | 153                  |
| Number of Words Written                                                                                              |               | 66       | 77                   |
| Rate                                                                                                                 |               | 22       | 26                   |
| Quality of Reproduction                                                                                              |               |          |                      |
| <div style="display: flex; justify-content: space-around;"> <span>50</span> <span>32</span> </div>                   |               |          |                      |
| The Gary Public Schools.                                                                                             |               |          |                      |
| <div style="display: flex; justify-content: space-around;"> <span>30</span> <span>(23)</span> <span>60</span> </div> |               |          |                      |

to be three minutes. Set the clock at 12:00. Start with bell and stop with bell. Have teacher time test with stop-watch. Record the time interval reported by teacher. For each test, give the warning signal: "Get ready. Hands up," and the stopping signal: "Stop. Put a cross in the right hand margin opposite the last question you have answered. Close your papers."

Distribute score cards. Have name, sex, age, and grade filled in.

For grades three, four, five, and six have the score cards placed within the test paper. Collect the papers.

For grades seven to twelve distribute the score cards. Have name, sex, age, and grade filled in, then have the pupils exchange papers and cards (twice).

# TABULATION SHEET

Test No. 8 B  
Form 14

The Gary Public Schools<sup>1</sup>

# 15  
Class Sheet

Examiner  
School Denny Grade \_\_\_\_\_ Date \_\_\_\_\_ Hour \_\_\_\_\_

| Reading Form 1 |               |                |                | Writing Form 2 |               |                |                |
|----------------|---------------|----------------|----------------|----------------|---------------|----------------|----------------|
| SCORE          | Boys<br>Freq. | Girls<br>Freq. | TOTAL<br>Freq. | SCORE          | Boys<br>Freq. | Girls<br>Freq. | TOTAL<br>Freq. |
| OVER           | <u>2</u>      | <u>3</u>       | <u>4</u>       | OVER           | <u>2</u>      | <u>3</u>       | <u>4</u>       |
| 48, 49, 50     | <u>337-1</u>  | <u>339</u>     | <u>384</u>     | 48, 49, 50     | <u>28-2</u>   | <u>30</u>      |                |
|                | <u>296-1</u>  | <u>332</u>     | <u>362</u>     |                |               | <u>28</u>      |                |
| 45, 46, 47     | <u>265-1</u>  | <u>332</u>     | <u>308</u>     | 45, 46, 47     | <u>26-1</u>   | <u>27</u>      |                |
|                | <u>256-1</u>  | <u>260</u>     | <u>301</u>     |                |               | <u>26</u>      |                |
| 42, 43, 44     | <u>241-1</u>  | <u>260</u>     | <u>299</u>     | 42, 43, 44     | <u>25-2</u>   | <u>25</u>      |                |
|                | <u>241-1</u>  | <u>243</u>     | <u>284</u>     |                |               | <u>25</u>      |                |
| 39, 40, 41     | <u>225</u>    | <u>237</u>     | <u>284</u>     | 39, 40, 41     | <u>24-1</u>   | <u>25</u>      |                |
|                | <u>207</u>    | <u>237</u>     | <u>266</u>     |                |               | <u>25</u>      |                |
| 36, 37, 38     | <u>206</u>    | <u>229</u>     | <u>266</u>     | 36, 37, 38     | <u>23-3</u>   | <u>23</u>      |                |
|                | <u>204</u>    | <u>216</u>     | <u>250</u>     |                |               | <u>23</u>      |                |
| 33, 34, 35     | <u>204</u>    | <u>184</u>     | <u>246</u>     | 33, 34, 35     | <u>22-1</u>   | <u>23</u>      |                |
|                | <u>186</u>    | <u>171</u>     | <u>234</u>     |                |               | <u>23</u>      |                |
| 30, 31, 32     | <u>176</u>    | <u>166</u>     | <u>215</u>     | 30, 31, 32     | <u>22-1</u>   | <u>22</u>      |                |
|                | <u>173</u>    | <u>160</u>     | <u>213</u>     |                |               | <u>22</u>      |                |
| 27, 28, 29     | <u>172</u>    | <u>160</u>     | <u>211</u>     | 27, 28, 29     | <u>20-1</u>   | <u>21</u>      |                |
|                | <u>172</u>    | <u>160</u>     | <u>205</u>     |                |               | <u>21</u>      |                |
| 24, 25, 26     | <u>163</u>    |                | <u>200</u>     | 24, 25, 26     | <u>19-1</u>   | <u>20</u>      |                |
|                |               | <u>147</u>     |                |                |               | <u>20</u>      |                |
| 21, 22, 23     | <u>154</u>    | <u>147</u>     | <u>200</u>     | 21, 22, 23     | <u>19-1</u>   | <u>20</u>      |                |
|                | <u>144</u>    | <u>141</u>     | <u>201</u>     |                |               | <u>17</u>      |                |
| 18, 19, 20     | <u>154</u>    | <u>135</u>     | <u>201</u>     | 18, 19, 20     | <u>19-1</u>   | <u>17</u>      |                |
|                | <u>149</u>    | <u>123</u>     | <u>191</u>     |                |               | <u>17</u>      |                |
| 15, 16, 17     | <u>138</u>    | <u>123</u>     | <u>181</u>     | 15, 16, 17     | <u>18-1</u>   | <u>16</u>      |                |
|                |               | <u>114</u>     | <u>162</u>     |                |               | <u>16</u>      |                |
| 12, 13, 14     | <u>136</u>    | <u>112</u>     | <u>140</u>     | 12, 13, 14     | <u>16-1</u>   | <u>15</u>      |                |
|                | <u>136</u>    | <u>109</u>     | <u>140</u>     |                |               | <u>15</u>      |                |
| 9, 10, 11      | <u>136</u>    | <u>62</u>      | <u>134</u>     | 9, 10, 11      | <u>15-1</u>   | <u>11</u>      |                |
|                | <u>130</u>    |                | <u>106</u>     |                |               | <u>11</u>      |                |
| 6, 7, 8        | <u>95</u>     | <u>44</u>      | <u>76</u>      | 6, 7, 8        | <u>12-1</u>   | <u>9</u>       |                |
| 3, 4, 5        | <u>91</u>     |                |                | 3, 4, 5        | <u>11-1</u>   |                |                |
| 0, 1, 2        |               |                |                | 0, 1, 2        | <u>5-1</u>    |                |                |
| Total          | <u>27</u>     | <u>27</u>      | <u>27</u>      | Total          | <u>24</u>     | <u>27</u>      |                |
| Median         | <u>173</u>    | <u>160</u>     | <u>213</u>     | Median         | <u>19.5</u>   | <u>22.0</u>    |                |

Possible errors: Scoring \_\_\_\_\_ Tabulating \_\_\_\_\_ Miscellaneous \_\_\_\_\_  
Actual errors: Scoring \_\_\_\_\_ Tabulating \_\_\_\_\_ Miscellaneous \_\_\_\_\_  
Accuracy \_\_\_\_\_

<sup>1</sup>This sheet was designed for tabulating results of cancellation tests, but was used as shown.

Then say: "Here is a large score card like the small one you have. Watch me score a paper. The correct answer to the first one is 'yellow' (pointing). It is yellow on this paper so I will mark this score C; the second answer, etc.; this answer is wrong so I will mark out the score with a cross. This is the last answer on the paper, so I will mark out all the rest of the scores. Now I will add all the scores not crossed out and write the sum here. Score your paper in this same way. If you don't understand, study the instructions on the card. When you have found your total score, record it after the word 'Score' here (pointing)." Collect the cards by rows.

Have the papers exchanged again. Distribute new score cards. Have each child fill out a card from the paper he now has, following the same procedure as before. Collect the cards.

#### TRABUE LANGUAGE SCALE

*Instructions.*—"I have another reading test to-day. This sheet contains some incomplete sentences, which form a scale. This scale is to measure how carefully and rapidly you can think, and especially how good you are in your language work. You are to write one word on each blank, in each case selecting the word which makes the most sensible statement. You may have just seven minutes in which to sign your name at the top of the page and write the words that are missing. The paper will be passed to you face downward. Do not

# ANSWER AND RECORD CARD

Name Marjorie Hall BOY OR GIRL Kansas Reading Test

Age 12 Grade 8A-18 Score 19.7  
18.7

## INSTRUCTIONS

26.5

The opposite side of this card gives the correct answers. Compare each answer on the test paper with the corresponding answer on the card. When an answer is wrong, draw a line through the value for that answer in the column headed Score. In the same way mark out the scores of all exercises not tried. Find the total of all the scores not crossed out and record it at bottom of the column and after the word score above.

Answers to tests for Grades 5, 6, 7, 8

The Gary Public Schools.

71 acc.

| SCORE CARD          |                                                                                       |       |
|---------------------|---------------------------------------------------------------------------------------|-------|
| KANSAS READING TEST |                                                                                       |       |
|                     | Correct Answer                                                                        | Score |
| 1                   | <u>Harry</u>                                                                          | C 1.0 |
| 2                   | <u>white</u>                                                                          | C 1.3 |
| 3                   | <u>opaque</u>                                                                         | C 1.6 |
| 4                   | <u>rabbit</u> shepherd dog                                                            | X 2.0 |
| 5                   | <u>If you find a word</u>                                                             | C 2.2 |
| 6                   | <u>John's</u>                                                                         | C 2.3 |
| 7                   | <u>4</u>                                                                              | C 2.4 |
| 8                   |    | X 2.6 |
| 9                   | <u>First</u>                                                                          | X 3.0 |
| 10                  | <input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | C 3.9 |
| 11                  | <u>curfew</u> <u>ploughman</u>                                                        | C 4.0 |
| 12                  | <u>success</u> failure                                                                | 4.0   |
| 13                  | <u>2 hrs</u>                                                                          | 4.3   |
| 14                  | <u>is</u> melted                                                                      | 4.9   |
| 15                  | <u>compose</u>                                                                        | 5.8   |
| 16                  | <u>30 yrs.</u>                                                                        | 10.2  |
| Total               |                                                                                       | 19.7  |

# TABULATION SHEETS—CONVENTIONAL SCORES

FROEBEL

Grade 8 H.

746

(This record sheet is to be returned to the Bureau of Educational Measurements and Standards, Kansas State Normal School, Emporia, Kan. A duplicate may be retained by the teacher. If needed, additional copies of this record sheet will be sent free.)

## Kansas Silent-reading Test—Class Record Sheet

Examiner

City

School

Class

Grade

10.15

Teacher

Date 4-11-16

### DISTRIBUTION OF PUPILS' SCORES.

| Test # I.                          | Number Pupils | Instructions for Making the Distribution of Pupils' Scores, and for Finding the Median Score                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of pupils whose scores fall |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 0 and 9.....               | 1             | 1. The teacher must be careful that her papers are grouped correctly by classes. If she has but one grade of pupils, say 5th grade, or but two divisions of one grade, say 5th A and 5th B, then her papers are all grouped together and but one "distribution" made. If, however, she has parts of two or more grades, say part 5th and part 6th, she must make two or more piles of papers, one for each grade.                                                                                                |
| between 1 and 1.9.....             | 1             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 2 and 2.9.....             |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 3 and 3.9.....             |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 4 and 4.9.....             |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 5 and 5.9.....             |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 6 and 6.9.....             |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 7 and 7.9.....             |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 8 and 8.9.....             |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 9 and 9.9.....             |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 10 and 10.9.....           | 1             | 2. Arrange the children's papers for any class group in order of scores, the lowest score on top.                                                                                                                                                                                                                                                                                                                                                                                                                |
| between 11 and 11.9.....           | 4             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 12 and 12.9.....           | 5             | 2. To make the distribution called for, count the number of papers whose scores fall within the successive groups listed. For instance, if the lowest score is 3.5, the next lowest 5.7, the next 7.1, 7.8, 8.3, and so on, you will put "1" in group marked "between 3 and 3.9," "1" in the group marked "between 5 and 5.9," "3" in the group marked "between 7 and 7.9," and so on until the whole number of scores are recorded. The sum of these numbers must equal the number of children taking the test. |
| between 13 and 13.9.....           | 7             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 14 and 14.9.....           | 5             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 15 and 15.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 16 and 16.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 17 and 17.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 18 and 18.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 19 and 19.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 20 and 20.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 21 and 21.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 22 and 22.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 23 and 23.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 24 and 24.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 25 and 25.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 26 and 26.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 27 and 27.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 28 and 28.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 29 and 29.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 30 and 30.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 31 and 31.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 32 and 32.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 33 and 33.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 34 and 34.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 35 and 35.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 36 and 36.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 37 and 37.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 38 and 38.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 39 and 39.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 40 and 40.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 41 and 41.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 42 and 42.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 43 and 43.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 44 and 44.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 45 and 45.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 46 and 46.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 47 and 47.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 48 and 48.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 49 and 49.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 50 and 50.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 51 and 51.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 52 and 52.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 53 and 53.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 54 and 54.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 55 and 55.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 56 and 56.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 57 and 57.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 58 and 58.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 59 and 59.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 60 and 60.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 61 and 61.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 62 and 62.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 63 and 63.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 64 and 64.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 65 and 65.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 66 and 66.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 67 and 67.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 68 and 68.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 69 and 69.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 70 and 70.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 71 and 71.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 72 and 72.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 73 and 73.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 74 and 74.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 75 and 75.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 76 and 76.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 77 and 77.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 78 and 78.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 79 and 79.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 80 and 80.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 81 and 81.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 82 and 82.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 83 and 83.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 84 and 84.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 85 and 85.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 86 and 86.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 87 and 87.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 88 and 88.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 89 and 89.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 90 and 90.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 91 and 91.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 92 and 92.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 93 and 93.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 94 and 94.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 95 and 95.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 96 and 96.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 97 and 97.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 98 and 98.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| between 99 and 99.9.....           |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 80 and above.....                  |               | 4. The median score is the score on the middle paper in the pile of papers arranged according to size of scores. If there are 35 papers, the median score is the score on the 18th paper. If there are 36 papers, the median score is half way between the score on the 18th paper and the score on the 19th paper                                                                                                                                                                                               |
| Total number of children.....      | 24            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Median score.....                  | 18            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

6-1264

(OVER)

18

Tabulated by  
E. S. Sheets

# RATE AND ACCURACY SCORES

Class  
Record  
Sheet

Gary Public Schools

TEST 2, I

## KANSAS READING TEST

School Shoebel Class No. 46 Grade 2a

Scores—Speed 21.0-23.0 Accuracy 85.0 % Standard

| SPEED | PER CENT OF ACCURACY |       |       |       |       |       |       |      |    | Total |
|-------|----------------------|-------|-------|-------|-------|-------|-------|------|----|-------|
|       | 1-10                 | 20-30 | 40-50 | 60-70 | 70-75 | 80-90 | 90-95 | 100  |    |       |
| 41    | .4                   | 2.5   | 14.4  | 24.0  | 29.7  | 28.8  | 28.9  | 41.0 |    | 1     |
| 40    | .4                   | 9.0   | 26.0  | 24.0  | 29.0  | 29.0  | 29.0  | 40.0 |    |       |
| 39    | .4                   | 7.0   | 18.0  | 29.4  | 27.3  | 21.3  | 25.1  | 29.0 |    |       |
| 38    | .4                   | 7.0   | 18.0  | 29.5  | 26.6  | 20.4  | 24.9  | 29.0 |    |       |
| 37    | .4                   | 7.4   | 14.0  | 29.2  | 25.9  | 29.5  | 29.2  | 27.0 |    |       |
| 36    | .4                   | 7.0   | 14.4  | 21.0  | 29.2  | 28.9  | 29.4  | 29.0 |    |       |
| 35    | .4                   | 7.0   | 14.0  | 21.0  | 24.5  | 29.0  | 25.5  | 29.0 |    |       |
| 34    | .9                   | 6.0   | 19.0  | 29.4  | 23.8  | 27.3  | 20.6  | 24.0 |    |       |
| 33    | .9                   | 6.0   | 19.0  | 19.0  | 22.1  | 29.4  | 29.7  | 29.0 |    |       |
| 32    | .9                   | 6.4   | 19.0  | 19.0  | 22.4  | 29.0  | 29.8  | 29.0 |    | 1     |
| 31    | .9                   | 6.9   | 18.4  | 18.0  | 21.7  | 24.8  | 27.9  | 21.0 |    |       |
| 30    | .9                   | 6.0   | 12.0  | 18.0  | 21.0  | 24.0  | 27.0  | 20.0 |    |       |
| 29    | .9                   | 6.0   | 11.0  | 17.4  | 20.3  | 29.3  | 26.1  | 29.0 |    |       |
| 28    | .9                   | 6.0   | 11.3  | 16.9  | 19.0  | 22.4  | 25.2  | 29.0 |    |       |
| 27    | .9                   | 6.4   | 10.0  | 19.2  | 18.0  | 21.0  | 24.3  | 27.0 |    | 1     |
| 26    | .9                   | 6.3   | 10.4  | 18.0  | 18.3  | 20.0  | 26.4  | 29.0 |    |       |
| 25    | .9                   | 6.0   | 10.0  | 15.0  | 17.5  | 20.0  | 29.3  | 29.0 |    |       |
| 24    | .9                   | 6.0   | 9.0   | 14.4  | 16.0  | 19.3  | 21.0  | 24.0 |    |       |
| 23    | .9                   | 4.0   | 9.2   | 18.0  | 16.1  | 18.4  | 20.7  | 29.0 |    | 9     |
| 22    | .9                   | 4.4   | 8.0   | 12.9  | 15.4  | 17.0  | 19.3  | 29.0 |    |       |
| 21    | .9                   | 4.9   | 8.4   | 12.0  | 14.7  | 16.0  | 19.0  | 21.0 |    |       |
| 20    | .9                   | 4.0   | 8.0   | 12.0  | 14.0  | 16.0  | 19.0  | 20.0 |    | 2     |
| 19    | .9                   | 3.0   | 7.0   | 11.4  | 13.3  | 15.3  | 17.1  | 19.0 |    |       |
| 18    | .9                   | 3.0   | 7.0   | 10.0  | 12.0  | 14.4  | 16.2  | 19.0 |    | 25    |
| 17    | .9                   | 3.4   | 6.0   | 10.0  | 11.0  | 12.0  | 15.3  | 17.0 |    |       |
| 16    | .9                   | 3.0   | 6.4   | 9.0   | 11.2  | 12.3  | 14.4  | 16.0 |    | 1     |
| 15    | .9                   | 3.0   | 6.0   | 9.0   | 10.5  | 12.0  | 13.5  | 15.0 |    |       |
| 14    | .1                   | 2.0   | 6.0   | 8.4   | 9.0   | 11.3  | 12.0  | 14.0 |    | 3     |
| 13    | .1                   | 2.0   | 5.2   | 7.0   | 9.1   | 10.4  | 11.7  | 13.0 |    |       |
| 12    | .1                   | 2.4   | 4.8   | 7.0   | 8.4   | 9.0   | 10.0  | 12.0 |    | 1     |
| 11    | .1                   | 2.0   | 4.4   | 6.0   | 7.7   | 8.0   | 9.0   | 11.0 |    |       |
| 10    | .1                   | 2.0   | 4.0   | 6.0   | 7.0   | 8.0   | 9.0   | 10.0 |    |       |
| 9     | .1                   | 1.5   | 3.6   | 5.4   | 6.3   | 7.3   | 8.1   | 9.0  |    |       |
| 8     | .1                   | 1.0   | 2.9   | 4.0   | 5.0   | 6.4   | 7.0   | 8.0  |    |       |
| 7     | .1                   | 1.4   | 2.0   | 4.0   | 4.9   | 5.6   | 6.3   | 7.0  |    |       |
| 6     | .1                   | 1.2   | 2.4   | 3.0   | 4.0   | 4.9   | 5.4   | 6.0  |    |       |
| 5     | .1                   | 1.0   | 2.0   | 3.0   | 3.6   | 4.0   | 4.5   | 5.0  |    |       |
| 4     | .0                   | .0    | 1.0   | 2.4   | 3.0   | 3.3   | 3.6   | 4.0  |    |       |
| 3     | .0                   | .0    | 1.0   | 1.0   | 2.1   | 2.4   | 2.7   | 3.0  |    |       |
| 2     | .0                   | .4    | .0    | 1.2   | 1.4   | 1.0   | 1.0   | 2.0  |    |       |
| 1     | .0                   | .0    | .4    | .0    | .7    | .0    | .0    | 1.0  |    |       |
| 0     | .0                   | .0    | .0    | .0    | .0    | .0    | .0    | .0   |    |       |
| Total | 1                    | 1     | 1     | 2     | 4     | 6     | 5     | 4    | 24 |       |

turn it over until we are all ready. After the signal is given to start, remember that you are to write just one word on each blank and that your score depends on the number of perfect sentences you have at the end of seven minutes."

The papers are then distributed

"After you have been working seven minutes, I shall say: 'Stop.' You will all please stop at once. Now if you are all ready, when the bell rings you may turn your papers over, sign your names and fill the blanks."

Five seconds before the signal from the automatic timer, the warning: "Get ready" was given, and when the bell rang, the command "Start" was also given. Seven minutes later, when the bell rang the second time, the command "Stop" was given, and then the instructions: "Mark a cross just before the number of the sentence at which you stopped. Now write 'boy' or 'girl' after your name at the top of the sheet. Then just below your name, write your age, your grade, and the hour. Turn your papers face down. The children at the back of the room please collect the papers for me."

TRABUE LANGUAGE SCALES

ANSWER AND RECORD CARD

46  
Name Lane, John <sup>FROEDEL</sup>  
Boy or Girl \_\_\_\_\_ Age 14 Grade 8 B.

Trials—Test 4—Trabue

|           |          |           |           |       |
|-----------|----------|-----------|-----------|-------|
| 16<br>B   | 18<br>C  | 12<br>D   | 14<br>E   |       |
| <u>13</u> | <u>9</u> | <u>11</u> | <u>11</u> |       |
| 91.2      | 64.3     | 91.6      | 78.5      | _____ |

Deviations from Weighted Score

Weighted Score

Irregularities

The Gary Public Schools



# TABULATION SHEET

FROEBEL

Test No. 1  
Rate of Work

The Gary Public Schools

Class Sheet

Teacher Proffer Date 2-21-16 School 2-21-16 Grade 2 Date 2-21-16 Hour 2-21-16

| Trial  |              |               |               | Trial  |              |               |               |
|--------|--------------|---------------|---------------|--------|--------------|---------------|---------------|
| SCORE  | Boys<br>Fig. | Girls<br>Fig. | TOTAL<br>Fig. | SCORE  | Boys<br>Fig. | Girls<br>Fig. | TOTAL<br>Fig. |
| OVER   |              |               |               | OVER   |              |               |               |
| 160    |              | 1             |               | 160    |              |               |               |
| 150    | 3            | 1             | 2             | 150    | 1            |               |               |
| 140    | 5            | 1             | 5             | 140    | 3            |               |               |
| 130    | 4            | 3             |               | 130    | 2            |               |               |
| 120    | 4            | 2             | 4             | 120    | 3            |               |               |
| 110    | 2            | 4             | 4             | 110    | 3            |               |               |
| 100    |              |               | 3             | 100    | 4            |               |               |
| 90     |              | 1             |               | 90     | 1            |               |               |
| 80     | 2            | 2             | 3             | 80     | 1            |               |               |
| 70     |              |               |               | 70     |              |               |               |
| 60     | 2            |               |               | 60     | 1            |               |               |
| 50     |              |               |               | 50     |              |               |               |
| 40     |              |               |               | 40     |              |               |               |
| 30     |              |               |               | 30     |              |               |               |
| 20     |              |               | 1             | 20     |              |               |               |
| 10     |              |               |               | 10     |              |               |               |
| 0      |              |               |               | 0      |              |               |               |
| Total  | 22           | 15            | 22            | Total  | 19           |               |               |
| Median | 13.3         | 12.5          | 12            | Median | 12           |               |               |
|        | 13.3         | 12            | 12            |        | 11.6         |               |               |

Possible errors: Scoring af 4 Tabulating N 4 Miscellaneous af 7  
Actual errors: Scoring  Tabulating  Miscellaneous   
Accuracy

Curtis

This sheet was designed for the test in copying figures, but was adapted to the needs of this test as above.

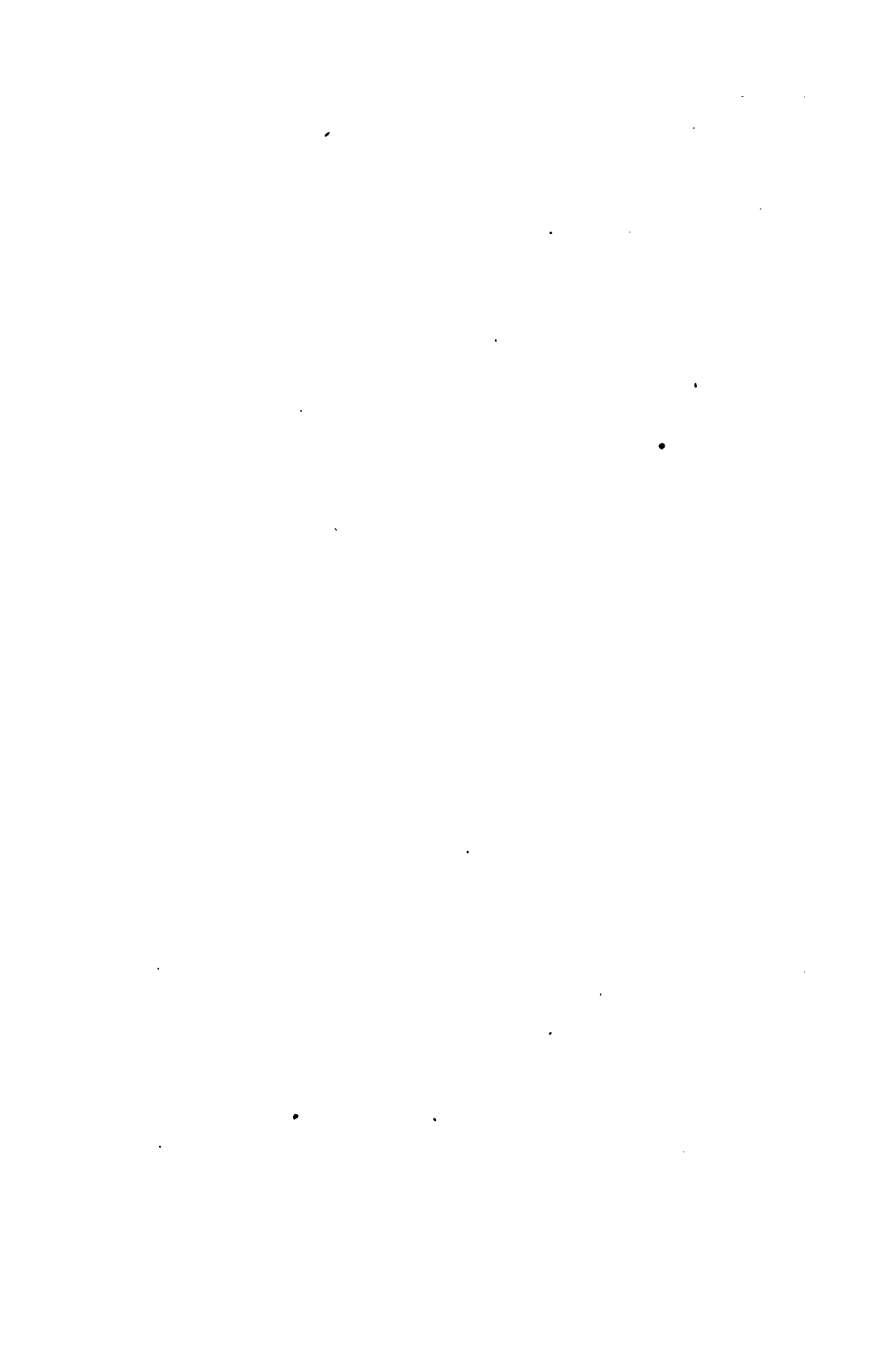
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